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ABSTRACT

A study investigated the functional relationship that exists when mental ability and language competence are separately and simultaneously measured with regard to their influence on the effective treatment of verbal information. Data were gathered from 100 men and women, aged 20-60, who were tested for language competence, reading comprehension, intelligence, and writing ability. Results revealed that syntactical skills were the major component for assessing English composition; and that skill in the use of language was of greater significance than was mental ability in the treatment of verbal information, particularly in exercises which call for critical analysis and the making of sound judgments. The findings suggest that the assessment procedures used in this research may be a feasible means of judging the quality of adults' written language. (Twenty tables of data are included; 166 references and eight appendixes containing testing materials are attached.)
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THE RELATIONSHIP BETWEEN SPECIFIC LANGUAGE VARIABLES AND MENTAL ABILITY IN THE TREATMENT OF INFORMATION BY ADULTS

by

ERIC HAMPSON

M.Ed., University of British Columbia

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF

THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF EDUCATION

in

THE FACULTY OF GRADUATE STUDIES

Educational Psychology and Special Education

We accept this thesis as conforming

to the required standard

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THE UNIVERSITY OF BRITISH COLUMBIA

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ABSTRACT

Supervisor: Dr. P.R.S Koopman

Title: The Relationship between Specific Language Variables and
Mental Ability in the Treatment of Verbal Information by Adults

This research attempted to determine the functional relationship that exists when mental ability and language competence are separately and simultaneously measured for their influence on the treatment of verbal information.

The assessment of language included skill in syntax, exemplified by verb-form competence, variety of clausal structures, and the employment of other modifying devices. The procedures for assessing these competencies were developed by the author.

Comprehension was measured by a standard reading comprehension test, comprising a series of graded paragraphs. Multiple-choice questions were posed on specific information regarding the characters and events, inferences and implications of the content, and recall of the actions and settings presented in the paragraphs.

Intelligence was measured by a non-verbal intelligence test, which called for the identification of geometrical patterns and learned skills in matching, analogies, classifications, intersections, and progressions.

Skill in processing verbal information was assessed from subjects' written comments on one of six controversial topics, presented by means of questions and related collages. The samples of language were scored for quality of argument and quality of judgment. The procedure for this scoring was the author's modification of the guidelines developed by Schroder, Driver, & Streufert (1967).

The main findings were that syntactical skills were the major component for assessing English composition; and skill in the use of language was of greater significance than was mental ability in the treatment of verbal information, particularly in exercises which call for critical analysis and the making of sound judgments. This finding suggests that the assessment procedures used in this research may be a feasible means of judging the quality of adults' written language.

The demographic variables of the subjects (*Age, Socio-economic Status, Education, Occupation*) did not serve to differentiate between high and low performance in language in any reliable way, although level of education had some bearing on ability in language and category of occupation among middle and upper age-groups.

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ABSTRACT

The main focus of this research was to determine the functional relationship that exists when mental ability and language competence are separately and simultaneously measured with regard to their influence on the effective treatment of verbal information.

The subject sample comprised 100 men and women, aged 20-60 years, who were chosen to be representative of the employable population of the Greater Vancouver area.

The assessment of language in these subjects included skill in syntax, exemplified by verb-form competence, the variety of clausal structures employed, and the presence of other modifying devices common to adult language. The procedures for assessing these competencies were originally developed by the author from raw data supplied by Koopman (1985).

Comprehension was measured by means of a standard reading comprehension test, which comprised a series of graded paragraphs. Multiple-choice questions were posed on specific information regarding the characters and events, inferences and implications of the content, and recall of the actions and settings presented in the paragraphs.

Intelligence was measured by a non-verbal intelligence test, which called for the identification of geometrical patterns and learned skills in matching, analogies,

classifications, intersections, and progressions.

Skill in processing verbal information was assessed from the subjects' written productions. Six controversial topics were presented to the subjects by means of questions and related collages. The subjects were asked to present, in writing, a solution to one of the issues. The time suggested for this task was approximately fifteen minutes. The compositions were scored for quality of argument and maturity of judgment.

All scores were analyzed by regression and multiple regression procedures. Demographic data were investigated by canonical correlation analysis.

The main finding of this present research was that skill in syntax is the major component in English composition, particularly in exercises which call for critical analysis and the making of sound judgments. This finding suggests that the assessment procedures used in this research may be a feasible means of judging the quality of adults' written language.

The results also indicated that skill in the use of language is of greater significance than is mental ability in the treatment of verbal information.

The demographic variables of the subjects do not serve to differentiate between high and low performance in language in any reliable way, although level of education

has some bearing on ability in language and category of occupation among the middle and upper age-groups.

Finally, practical application of these assessment procedures in education and suggestions for further research directly concerned with this study and with issues in related fields are discussed.

B. B. Koopsman

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CHAPTER 1. LANGUAGE, MENTAL ABILITY, AND INFORMATION

THE NATURE OF THIS STUDY

This study is concerned with examining the relationships among specific language variables, mental ability, and the capacity for developing verbal information as the bases for problem solving.

An essential function of language is communication, which includes understanding the opinions and intentions of others, and expressing one's own ideas.

Understanding is dependent on the analysis and synthesis of information. There is the need to recognize and to integrate relationships among items of knowledge, and to use the complex patterns thus formed as the basis for the interpretation and appreciation of problems that may arise in, say, complex social situations.

Understanding, according to Guilford (1973), embraces "immediate discovery, awareness, re-discovery, or recognition of information in various forms [p.636]." Bruner (1973) suggested that it is fruitful to distinguish three systems for processing the information "by which human beings construct models of their world [p.161]." These are action, imagery, and language, which Bruner later refers to, respectively, as enactive representation, iconic representation, and symbolic representation. The critical

and mature form of representation appears to be through language, the "medium for the translation of experience [p.165]."

The intellectual functioning, which is implied by the operations mentioned above, is subsumed under the general category of mental ability, a quality customarily assessed in some of its manifestations by a standard intelligence test. The innate quality of intellectual functioning is likely not to be susceptible of much improvement, although skill in responding to the tests that are employed to determine it may well be. Consequently, if the ability of individuals to interpret and convey verbal information is to be improved, one needs to focus the main efforts in the area of language.

The question of the relative significance of mental ability and specific language variables in the interpretation and use of verbal information has increasingly become an issue as more people in more areas are exposed to more news, commentaries, and advertizing. The terse style of much modern news reporting, the bias that can so cleverly be introduced, and corruption of the language which is characteristic of the most popular media are reason enough for believing there may be a problem that offers ground for investigation.

The above problem also became an issue for this

researcher during further analysis of data previously collected by Koopman for her studies for the Government of Canada (Koopman, 1985; 1988). These studies concerned the cognitive abilities of various atypical individuals. Among the tasks set for these individuals was the recording of a sample of their oral language, later to be transcribed and scored for (a) competence in syntax and (b) maturity in resolving problems. Subjects also were asked to complete a non-verbal intelligence test.

An examination of the test scores indicated that there was a very low correlation between those for maturity in resolving current social problems, as assessed by the scale developed by Schroder, Driver, and Streufert (1967), and the scores obtained for intelligence. Between the language variables and the resolution of the type of problem referred to above, the correlation was substantial. A plausible explanation of this anomaly could be based on the characteristics of the various tests that were employed, a situation that is referred to later, in Chapter 5 (*Hypotheses 4 & 12*), in connection with the present study.

The issues presented, in particular by the Koopman (1985, 1988) studies, suggested the need for additional investigation, using a revised and more refined version of the procedure already employed for measuring adult syntax, and with subjects drawn from the general population of

employable men and women.

In investigations which concern individuals, a researcher is usually faced with the influences of demographic factors and the personal experiences of those who take part in the study. This researcher has addressed this particular issue in Chapter 6 (**Limitations**).

PARTICIPATION OF SUBJECTS

This researcher interviewed and tested one hundred adults, aged 20-60 years, from various socio-economic groups and levels of education, and thus more representative of the general population than were those who had participated in the studies mentioned above.

The subjects were asked to complete a personal history form, to express their opinions in writing about a topic of controversial interest, and to take standardized tests in reading comprehension and in intelligence.

RESEARCH OBJECTIVES

The objectives of this research study were:

1. To determine the relative significance of the effects of specific language variables and mental ability on the individual's skill in developing verbal information as the basis for the solution of problems of social concern.
2. To develop a procedure for measuring adult syntax.

3. To assess the influence of some common demographic variables on specific language variables.

RESEARCH PROBLEMS

The objectives listed above posed some problems of instrumentation and scoring in relation to two of the defined variables of this research: *Syntactic Performance* and *Information*. The first problem was to assess competence in selected aspects of syntax within the constraints imposed by time and the characteristics of those tested, in a manner which would supply the detail asked for in the research questions. It was necessary to select a limited yet representative number of syntactic elements. The bases of this selection are examined later in this chapter and in Chapter 2. Chapter 3 contains data pertaining to the relevant reliability and validity.

A second problem concerned the choice of written language as the medium for analysis. This justification for the choice of this medium in preference to spoken language is discussed below in this chapter (**THE CASE FOR WRITTEN LANGUAGE**).

The third problem was to show that a single language sample from each subject might be scored from two perspectives *viz.* (a) syntactical skills and (b) the quality of thought represented in the solution of a problem, by

procedures which in their essential nature circumvent the possibility of each of the quality of thought and the syntactic characteristics of the written language mutually determining the other. This issue is further examined in Chapter 3 (**A Question of Logic**).

THE CASE FOR WRITTEN LANGUAGE

The Major Concern

This research is concerned with adult written language, specifically skill related to syntactic structures, in a particular circumstance, *viz.* responding to potentially controversial questions by suggesting plausible solutions and justifying them. It is not concerned with spoken language in the context of linguistics.

Reactions of Subjects

The decision to ask for only written language was dictated by logistics and time constraints, which can be significant when adult subjects are unpaid and have given up some free time, or have agreed to accept the testing session as a substitute for an instructional period for which they have been charged a fee. Under these circumstances, a researcher must be prepared to assess subjects in groups, obviously with a test that can legitimately be administered

in this way.

In addition to these organizational problems, there is an important consideration related to performance. The comprehension of oral language makes heavier demands on the memory than does the understanding of written discourse. The subject can always look back at what he has just read, but he cannot "hear back." On the other hand, written language lacks the rich set of hints to comprehension that speech customarily furnishes: pitch, intonation, stress, and timing.

In particular, there is difficulty in recording scores when assessing the syntactic component in speech. As Bolinger (1975) has said, "If a specimen [of verbal language] is to be studied it must hold still—speech is too ephemeral [p.506]." Recording on tape is the obvious solution, when this can be done on an individual basis, which was not feasible in this study. Another potential disadvantage of recordings is the fact that unpractised speakers may find the experience intimidating, and, as a result, not produce natural and authentic composition.

For some individuals, the task of discussing any topic in a considered way is more easily achieved when there is time to think critically and jot down some main points before composing an answer that should strike a fair balance among various points of view and reveal evidence of a deeper

level of thinking than is usually characteristic of oral responses. However, one should perhaps accept with Tannen (1983) that:

> oral strategies underlie successful production of written discourse . . . differences between them may in fact grow out of other factors: specifically, communicative goals and relative focus on interpersonal involvement (p.60).

Palmer (1988) observed that writing is not supplementary to the the spoken word but a quite different performance, which is a caution that should be heeded; but, according to Crystal (1985), not to the exclusion of written language, for "both are English, and the above [the reversal of linguistics priorities] must not be exaggerated [p.60]."

Types of Language Samples

The type of language sample is also a significant factor. Language samples may be "free-writing" or "re-writing." The free-writing format requires candidates to produce an original composition. In re-writing, the candidates re-cast a paragraph or a series of sentences. There may be certain requirements, such as the production of particular forms of sentences, or the substitution of phrases for finite clauses, or the candidates may be left

free to make their own modifications.

Hunt (1977) referred to two of his unpublished studies (1970, 1974) with these observations: (a) re-writing has the advantage of the candidates' re-working the same passage, and differences in performance will be directly attributable to exclusively linguistic skills, (b) the examiner is free to present a particular task to the candidates. This freedom to focus on selected structures or processes makes for economy of time, and reduces the tedium of scoring. On the other hand, there is the danger of reaching a faulty conclusion on too limited an example of a person's ability in composition; and, as Hunt (1977) remarked, "The results attained will depend to some extent on the problems set. Insofar as the investigator sets an abnormal task he or she will get an abnormal result [p.92]." Obviously, with re-writing, the treatment of any information to be conveyed has already been partly accomplished in the production of the original piece or stimulus, and, by definition, any statement that is produced as a response cannot really represent the student's unencumbered interpretation of the subject-matter. In developing information, one must be able to judge levels of interpretation as a true reflection of what has been comprehended or inferred from the verbal or pictorial stimulus. This comprehension and the inferences therefrom are regarded as functions of syntactic and

semantic maturity and of mental ability.

It would seem that to test the relative importance of language and of intelligence in the treatment of information, free-writing must be the approach.

SELECTION AND DEFINITION OF VARIABLES

The variables selected for analysis were *Language Ability*, which comprises *Syntactic Performance* and *Comprehension; Mental Ability;* and *Information*. The elements comprising *Syntactic Performance* are *Score for Verbs, Variety of Clauses*, and *Elaboration of the Subject and Predicate*.

Below, each variable is strictly defined *in the context of this study*, and from the perspective of practices in adult education. Furthermore, in Chapter 2 (**SURVEY OF THE LITERATURE**), the author has limited his discussion to those aspects of each topic that are immediately relevant to this context and perspective.

Language Ability

This variable represents skill in the use of specific syntactic structures in free writing, and the ability to comprehend written language, as assessed by a reading comprehension test.

Syntactic Performance

Competence in arranging words to form grammatical sentences is the essence of this variable. These sentences should clearly reveal the mutual relationships of these words in acceptable discourse.

Comprehension

This variable is essentially the ability to understand written language, and to show the level of this understanding by answering questions which advance from the recital of facts to the recognition of inferences.

Mental Ability

As a term in general use, mental ability can be defined in so many ways that in the end confusion rather than clarification is the result. Boring (1923) declared that intelligence must be recognized as the capacity to do well in an intelligence test, which suggests that a researcher can legitimately define intelligence by adopting the test most appropriate for the investigation underway.

On the assumption that Spearman (1927) correctly identified in his noetic principles two fundamental operations (a) the eduction of relations and (b) the eduction of correlates, as the essence of general intelligence, this researcher selected a test in which these

principles were amply illustrated, and thus defined the variable for the purposes of this present research.

Information

The variable, as defined for this study, encompasses the recognition, selection, and subsequent organization of various kinds of verbal information from which the individual may develop opinions that are expressed in writing and become the bases for resolving some problem. This definition is a modification of that for information processing enunciated by Schroder et al. (1967), but obviously does not include information conveyed in the spatial, quantitative, and other dimensions.

ELEMENTS OF SYNTACTIC PERFORMANCE

Score for Verbs

It is reported that Jeremy Bentham distrusted the verb, especially in legal expressions. He thought of it as "slippery," with a meaning that was always moving, always variable (Bowring, 1962). Partridge (1949) declared that action is the chief feature of a verb: "A verb tells what some person or thing *does* or *what state* he or it *is in* or what is *becoming* of some person or thing [p.64]."

Partridge admitted to the clumsiness of this

definition; and in it there is certainly no basis for any assessment of complexity.

The verb can be a most potent and flexible element in a sentence. However, it is also the most difficult to use effectively. The concepts of subject and object and any reference to the relations between them are indefinable without this constituent which, through mood, tense, and aspect, is able to convey a wealth of nuances to any utterance. One finite verb may describe several actions or states, and a single action may be portrayed by a number of verbs. A mental set is thus established.

Mood, tense, and aspect are inextricably intertwined. In general, one may use such terms as "present tense" or "past tense," but always with an uneasy feeling that "present" and "past" do not mean quite what they seem to mean. When "future" is used in connection with verbs, the anomaly is even more obvious.

Variety of Clauses

Hunt (1965) examined the appropriateness of several units of syntactic significance as measures of maturity in language. Although his main concern was grammatical structures, he furnished researchers with data and directions which can save hours of fruitless enquiry. As he stated as a general comment in the *Foreword* of his study

(Hunt, 1965):

> Some of these details survive as markers of dead ends. They say, in effect, "The investigator thought this information might turn out to be worth picking up. You need not waste your time getting the same information all over again. Signs saying 'No Thoroughfare' should not all be torn down."

In particular, Hunt found that increases in mean clause length and the number of subordinate clauses were indicative of developing maturity, and can be measured by his new unit, the *Minimal Terminable Unit* or T-unit, which he defined as a main clause plus subordinate clauses and non-clausal structures attached to or embedded in it. The T-unit represents the shortest unit that may allowably be punctuated as a sentence. He defined a clause as a subject or co-ordinate subject with a finite predicate or finite co-ordinate predicates. The T-unit is said to preserve intelligibility more effectively than does a division into clauses during segmentation of a passage. This is so, but Sims and Crump (1983) pointed out that a mere increase in the number of subordinate clauses may be an indicator of immaturity in syntactic development in some instances. The crucial factor is whether or not the additional clauses constitute segments in one or more T-units. Andolina (1980)

stated as much when he confirmed that average T-unit length appeared to be a valid indicator of syntactic development. Further, if grade-placement also signals level of linguistic maturity, the best associated index is the length of the T-unit; the second best is mean clause length, and the poorest is sentence length (Hunt, 1965).

Hunt (1977) regarded the substitution of pronouns, particularly the relative pronoun, in a sequence of sentences as a sign of maturity in language, and in "Early Blooming and and Late Blooming Structures" (cited in Cooper & Odell, 1977, pp.91-104), he discussed the progression from a single sentence to compound and complex sentences, and also the conversion of clauses to phrasal structures, which he felt to be a significant stage in language development.

The segmented T-unit is the basis of the analysis of the variable *Syntactic Performance*. The fundamental relationship is that of a nominal subject to a verb, and on this are constructed complex sentences, with embedded and attached subordinate clauses, and various forms of elaboration. The compound sentence, comprising one subject or co-ordinate subjects with co-ordinate predicates, is essentially two T-units joined by a co-ordinate conjunction, a structure which Hunt (1977) stated "blooms early, immediately starts to die, but lingers on for years, being gradually smothered by relatives [p.97]." The T-unit itself

may be one of the sentences recognized in this present study (the simple, or complex sentence with subordinate clauses, phrases, and other forms of elaboration); but, as already mentioned, not the intact compound sentence, for the T-unit segments it.

Hunt (1977) does not supply a measure of clausal variety, and this researcher again referred to Crystal, Fletcher, and Garman (1976), Lee and Canter (1971), and the examples of adult writing supplied by Koopman (1985). The scheme eventually used in this study is a distillation of these sources.

Ultimately, frequency of occurrence in adult language, and the support of the relevant literature quoted earlier, suggested an order of complexity which recognized a progression from simple to compound to complex sentences, and within the complex category an order specifying time, reason, condition, result and consequence, and place as factors which modify the predicate of the main clause. The noun clause was treated separately as (a) the direct object and (b) the subject of the main clause. The adverbial clauses and the noun clause as subject were considered to be part of more complex structures than were the noun clause as object and the adjectival clause.

Elaboration of the Subject and Predicate

Elaboration of the subject and the predicate is essentially the addition of qualifying words and phrases to the noun or pronoun constituting it. These may be single adjectives or attributive and appositive phrases (Rosenbaum, 1967).

Elaboration includes the clausal modifications mentioned by Hunt (1977) as being particularly indicative of mature adult language: specifically, the transforming several successive clauses into phrases by replacing finite verbs with present participles. This transformation was a rhetorical device of particular interest to Christensen (1967) in his study of the subject, and is exemplified in this sentence taken by Hunt (1977) from his study.

> We caught two bass, hauling them briskly as though they were mackerel, pulling them over the side of the boat in a businesslike manner without any landing net, and stunning them with a blow on the back of the head (p.100).

Hunt (1977) pointed out that of the 300 persons from grades 4, 6, 8, 10, & 12, and a group of adults, who wrote the exercises in his study, not one produced this construction of the present participle. On a second occasion, of the higher grades, only two out of ten grade 12

students produced the construction, but at a university, nine out of ten students were able to do so.

SIGNIFICANCE OF THE DEMOGRAPHIC VARIABLES

There is a common perception that an individual's language is affected by various demographic variables. Among them are sex, age, socio-economic status, years of education, and present occupation.

The decision to proceed with an analysis of demographic data was based on the literature (Bernstein, 1962, 1972), and a preliminary analysis of data supplied by Koopman (1988). These latter data (N=89) yielded correlations, which are contained in Table 1. The abbreviations are for *Score for Verbs*, *Variety of Clauses*, and *Elaboration of the Subject and Predicate*.

Table 1.

Zero Order Correlations: Language and Demographic Variables.

Variables	*Sc. Verbs*	*Var. Cl.*	*Elab.*
Sex	0.004	0.141	0.212
Age	0.180	0.053	0.145
Educ.	0.338	0.259	0.280
Occup.	0.231	0.004	0.111

There is little evidence in the table of any strong and stable relationships among the demographic and language variables. However, because the sample, demographic variables, instruments, and testing procedures in the pilot study were not identical with those subsequently adopted in the present investigation, this researcher decided to analyze his later syntactic and demographic data in order to examine further the implied relationships.

RESEARCH QUESTIONS

The following questions arose directly from the research objectives listed in this chapter. In Chapter 4, each is re-phrased as a null hypothesis. Together they embody the speculations which this researcher wished to examine. These speculations concern the relationships that exist among the language variables, mental ability, and the manner in which verbal information is received and acted on by individuals.

1. What percentage of the variance in *Information* is contributed by *Language Ability*?
2. What percentage of the variance in *Information* is contributed by *Syntactic Performance*?
3. What percentage of the variance in the *Information* is contributed by *Comprehension*?
4. What percentage of the variance in *Information* is

contributed by *Mental Ability*, as assessed by an appropriate test?

5. What percentage of the variance in *Information* is contributed by the multiplicative effect of *Syntactic Performance* and *Comprehension*?
6. What percentage of the variance in *Information* is contributed by the multiplicative effect of *Mental Ability*, as assessed by an appropriate test, and *Syntactic Performance*?
7. What percentage of the variance in *Information* is contributed by the multiplicative effect of *Mental Ability*, as assessed by an appropriate test, and *Comprehension*?
8. What are the individual contributions of the elements constituting *Syntactic Performance (i.e. Score for Verbs, Variety of Clauses,* and *Elaboration of the Subject and Predicate*) to the percentage of variance in *Information*?
9. What percentage of the variance in *Information* is contributed by the multiplicative effect of *Score for Verbs* and *Variety of Clauses*?
10. What percentage of the variance in *Information* is contributed by the multiplicative effect of *Score for Verbs* and *Elaboration of the Subject and Predicate*?
11. What percentage of the variance in *Information* is

contributed by the multiplicative effect of *Variety of Clauses* and *Elaboration of the Subject and Predicate*?

12. What percentage of the variance in *Language Ability* is contributed by *Mental Ability*, as assessed by an appropriate test?
13. What percentage of the variance in *Information* is contributed by the multiplicative effect of *Mental Ability* and *Language Ability*?

Finally, the relationships among language and the several demographic variables were examined in this question:

14. What percentage of the variance in the language variables (*Score for Verbs*, *Variety of Clauses*, and *Elaboration of the Subject and Predicate*, and *Comprehension* is contributed by the demographic variables (*Age*, *Socio-economic Status*, *Education*, and *Occupation*).

SIGNIFICANCE OF THIS RESEARCH

On a scale not known in any previous age, the modern world is flooded with information of all kinds. Much of it is not significant in the lives of individuals, but there is still enough directed to all people to justify an examination of the prerequisites for understanding and acting on the items that are the basis of normal living in a

literate society. For individual survival, a citizen should be able to appreciate and respond to printed information, and to that reported by radio and television. Unfortunately, the quality of English employed by the more sensational journals and in some television programs seems to be leading to a tacit acceptance of imprecise language. This may be one of the consequences of a knowledge of the language that is not adequate to express the thoughts which are to be enunciated.

Of equal importance is the need for all citizens to be able to participate fully in a democratic society by understanding issues, and playing a suitable part in the political life of the state. An inability to fulfil these roles because of a language deficiency, particularly, may lead to such individuals' being regarded as inferior. This concern is the more urgent in Canada, where there is a significant and growing immigrant population whose first language is not English.

Another issue is the population of functionally-illiterate adults who are at a disadvantage when confronted by official notices, regulations, unfamiliar requests, and demands for explanation by, say, the police.

A third consideration is the self-confidence which can be the consequence of being fluent and literate in one's own and, more particularly, in a second language, especially

when seeking employment.

This research can also be justified when viewed from the perspective of those who teach in post-secondary classes. This issue is dealt with more fully in Chapter 6 (**Practical Applications**), and it is sufficient to point out here the need for more research into the purposes, organization, and methods of adult education, particularly in the areas impinging on modern communications. A sobering thought is to realize that "literacy rates in eighteenth-century France were much higher than in the late twentieth-century United States [Schama, 1989: p.180]."

CHAPTER 2. SURVEY OF THE LITERATURE

Philosophus grammaticam invenit

THE DEVELOPMENT OF GRAMMARS

Defining Grammar

The term "grammar" is defined in several ways, but three meanings encompass most of them. Grammar first may be seen as the system of a language, as the means of lending order and coherence to the words of the language, and the sounds associated with them.

The second meaning concerns the most effective way of describing the system of the language. The components customarily recognized as indispensable are the syntactic, semantic, pragmatic, and phonological. In this research, the phonological component was not a variable, and the pragmatic component was assessed directly by a reading comprehension test, and expressed and measured incidentally in the grading of language samples for thought and maturity.

The third meaning sets out the conventions and rules for the use of language that are currently acceded to by a majority of those speaking the language. These conventions and rules change over time, and may vary with social class and geographical dialects.

CONTENDING THEORIES OF GRAMMAR

Any discussion of grammar must of necessity begin with the recognition that there are contending theories which are held to vehemently, and argued competently, by their protagonists. Their treatment below is essentially introductory.

Traditional Grammar

The grammar of a natural language is the product of custom and of the consent of those for whom it is the accepted medium of communication.

In 1972, Quirk, Greenbaum, Leech, and Svartik produced a standard text, *A Grammar of Contemporary English*, (revised as *A University Grammar of English*, 1973, 1985), which continued a tradition of superb grammars in the traditional genre (Jespersen, 1933; Kruisinga, 1931, 1932; Poutsma, 1914-1929). Burchfield (1985) was prompted to remark: "Subject and predicate come sailing back into view. SVO (subject/verb/object) and SOV (subject/object/verb) stand as lighthouses to those adrift in the stormy seas of grammar [p.155]." There are other books for colleges and schools (Aarts & Aarts, 1981; Scheffer, 1975), and for readers who may not wish to contend with the subtleties of Bloomfield (1935), Chomsky (1986), Leech and Svartik (1975), and Quirk et al. (1972). They are all witness to the attraction that

explicit guidance (if not imposed rules) has for some people in the matter of language.

It will be obvious, from the discussions in Chapter 1, that this researcher has not departed substantially from the traditional terminology and analysis of syntax. His main objective was to develop a measure of syntactical competence; and for this purpose, he selected what he believed to be the minimum number of variables that would achieve this end, and recognized the simple sentence and basic transformations as fundamental to any measurement of syntax.

Departures from Tradition

The change from a traditional approach was most obviously recognized in the work of the structural grammarians (Fries, 1925, 1927, 1940, 1952, 1954, 1956; Bloomfield, 1935) and the subsequent developments represented by the Linguistic Circle of Prague, the followers of Firth (1966), Halliday (1967), Lamb (1966), Pike (1954, 1955), and Fillmore (1968). These authors proposed static systems of grammar, notwithstanding their obvious differences, and the truly radical departures from these systems and the views pertaining to the acquisition of language as a unique human attribute were the work of Chomsky (1957a) and a theory of language acquisition

favoured by the behaviourists (Skinner, 1957).

The approaches referred to above exemplify different ways of interpreting grammar. In particular, Halliday (1967), in systemic grammar, the generative semanticists, and most notably Fillmore (1968), considered the functions of the various parts of a sentence.

Fillmore specified more exactly the relations of noun phrases to verbs. He found that the concept of "subject" was too broad, for in a grammatical sentence the subject can be the agent who carries out an action, or the instrument which effects the action. Similarly, the object can be the person or thing that is the direct result of the action named in the sentence, or it can be anything for which there is a noun with a role in the sentence that depends on the way the verb is used; that is, the meaning of the verb determines the function of the noun. Cases are semantic relationships and are distinct from any particular suffixes or positions in the sentence for expressing them. Dale (1976) has illustrated the nature of the relationships:

> Noun phrases serving as subjects are not marked, regardless of their cases. Noun phrases in other positions are often identified by prepositions. For example, the agent is typically marked with *by (The door was opened by John)*, and the dative with *to (He gave the present to Mary)*, the objective with no

> preposition, the instrumental with *by* or *with* (depending on whether or not there is an agent specified in the sentence: *John opened the door with a key* or *The car was hit by a stone*), and the locative with a special set of prepositions that also add meaning (*in, on, under*, and so on) (p.86).

In addition to the cases mentioned in the passage above, Dale (1976) described the function of two other terms: (a) *Experiencer*, which refers to the person or animal undergoing a named experience; (b) *Factitive*, which refers to the person, animal, or thing existing as a result of the action specified.

All in all, case grammar postulated a structural level below deep structure by its more exacting definition of function.

Transformational-Generative Grammar

The theory of transformational-generative grammar (Chomsky, 1957a; Harris, 1951, 1952, 1960; Lieber, 1975; Newmeyer, 1986), in contrast to most of the views expressed so far, described grammar in dynamic terms. A sentence is the result of a process of building, and can be analyzed by reversing the process:

(a) S—>NP + VP; (b) VP—>V + COMPL. etc.

The alternative approach merely states that a sentence is a

noun-phrase (NP) plus a verb-phrase (VP), without implying process. Transformational-generative grammar more directly exemplifies the essential aim of all grammatical rules: to describe the mental mechanisms that enable human beings to generate a potentially infinite number of grammatical sentences from a finite corpus of utterances or observations.

The theory has passed through three main stages. Syntax was the field of activity in 1957-64, and this phase was followed by a realization that transformations could not be categorically divided into obligatory and optional classes, and that while a sentence may be represented by a surface structure, there is a deep structure to which meaning is given by the semantic component (Postal, 1964). The most recent development has been characterized by the elevation, as it were, of semantics, which was achieved by doing away with a static lexicon and regarding meanings as comparable with the phrase-markers in syntax. Transformations are still in order, but they now embody the semantic component as well as the syntactic in one continuous operation and at one level. This is described as the remote structure (Chafe, 1970; Lakoff, 1970; Ross, 1963).

Language as a Behaviour

Skinner's theories were repudiated by Chomsky (1957b), who has little time for a non-mentalist approach to language. Skinner saw language as just another form of behaviour in which there is a response and an effective reinforcement. It is reasonable to suppose that the language of any individual can be controlled by such mechanisms, but it difficult to accept that language is acquired in this way. The optimum period in childhood for language acquisition is too short, and what has to be achieved is too regular and too extensive and invariant over the entire pattern of development for acquisition to be attributed to a conditioning process. One may feel that Skinner's theory is too crudely simplistic and mechanical to furnish an acceptable explanation of how to assess the language of adults (Chomsky, 1957b).

There is also the question of style, which cannot be explained by a stimulus-response mechanism. If this were the situation, there would be little creativity. In language, there is never a standard response to every stimulus of a particular kind. Any reply is a function of personal and situational factors.

Skinner's views were ahistoric from the beginning. He did not admit of any influence in human and animal conduct other than the initial stimulus and subsequent

reinforcement, both of which might be initiated by environmental conditions or be contrivances of some third agent. As far as language was concerned, his theory gave no explanation for the various degrees of complexity in syntax and in comprehension which are exhibited by individuals. Skinner's is an extreme environmentalist position. As Rose (1976) remarked, "In a sense it is because Skinner is nearly right in some things that he is so fundamentally in error overall [p.348]."

Skinner did not offer, either on conceptual or procedural grounds, a means of assessing the quality of syntax.

BASES FOR ASSESSMENT

Assessment: *Syntactic Performance*

An attempt was made in the preliminary stages of this research to assess the complexity of Chomsky's transformations, and to arrive at a suitable metric. As mentioned above, this researcher could find no solid evidence that such a measure, when applied to adult syntax, would hold in a consistent fashion. Frank and Osser (1970) had attempted a similar task in connection with the syntax of language in general, but equating the number of transformations with observable levels of syntactical

complexity was found to be an unreliable index (Fodor & Garrett, 1966).

Depth of clause subordination is another measure that was explored. It is predicated on hypothetical strata in construction and meaning, though at the level of the subordinate clause. First order dependency is the clause attached to, or embodied in, the main clause; and any other clauses contained in the dependent clauses represent second and third levels of dependency. These latter indices are usually not encountered frequently enough to make clause subordination a completely useful measure of language maturity at the lower levels of competence.

The difficulty seems to be attributable to the way in which adults acquire and develop facility with new constructions. Unlike the developmental language of children, adult language does not exhibit a characteristic pattern in the acquisition of linguistic structures. For adults, the acquisition of certain forms may be dictated, for instance, by the demands of a particular form of occupation, and will be modified as new technologies are introduced or when the individual changes occupation.

Miller and Coleman (1967) described procedures for calibrating a passage of English for complexity. Newman and Gerstman (1952) concentrated on analyzing printed English through frequency and sequence of letters. They created a

statistic, the *coefficient of constraint*, "which behaves roughly in the same way as does the coefficient of correlation [p.115]." Chotlos (1944) used the type-token ratio (TTR), or the ratio of the number of different words (types) to the total number words (tokens) in a given language sample. The analysis can be applied to the nouns, verbs, adjectives, adverbs and any other constituents of the sentence. By this means, one can obtain a fair amount of information on the relative use of nouns, verbs, and other "parts of speech", but these data do not appear to be a necessary part of any assessment of quality. It is essentially quantitative. Consequently, for this present research, it was not an appropriate measure.

Realizing that transformational generative grammar and immediate constituent analysis offered little in the way of a scale for assessing adult language, this investigator explored several avenues characterized by a mathematical approach, but with little success. Although Harris (1968) continued to pursue the possibility of applying mathematical models to language, difficulties and disappointments have, in general, beset other research workers who have tried to use this type of system.

Mathematical procedures have a strong attraction for structural linguists with behaviourist leanings, but not for this group exclusively. Osgood (1953) stated unequivocally:

> A final impression one gets is this: language behavior is clearly a learned activity—as a matter of fact it is by all odds the most complex product of learning mechanisms to be found. Language behavior is also composed of units whose quantities and interrelations are readily described in mathematical terms (p.727).

Miller (1951), Herdan (1960), and Hockett (1967) explored the possibility of deriving a reliable index of complexity from mathematical techniques applied to a variety of language forms (sentence-length, style of punctuation, verb-adjective ratio, for example), but none really supplied a comprehensive index of measurement for language, as it is used.

These studies, for all their scientific and statistical rigour and undoubted value to other researchers in similar fields, exemplify why such data do not furnish those in the social sciences with a usable technique for assessing language. There is a tedium and a narrowness of focus about these studies that tend to be daunting and demanding of too much time in relation to their diagnostic and prognostic value, when the subjects for an enquiry are adults.

Consequently, this researcher avoided any measure that was based on a single index, supposedly representative of syntax, and instead developed a form of assessment which

acknowledged the verb, clausal variety, and elaboration of the subject and the predicate as being essential elements in the syntactic component. As will be seen from the scoring patterns contained in Chapter 3, the underlying and variable characteristic in scoring these elements is complexity, as reflected in frequency of use.

Assessment: *Comprehension*

This variable is concerned with the meaning in the context of receptive language, whether it be a sentence or a single word. The phrase and the clause, as constituents of the sentence, are of the most concern, and studies mainly directed to the meaning of words (Bolinger,1965, 1975; Katz & Fodor, 1963; Osgood, Suci, & Tannenbaum, 1957; Rips, Shoben & Smith, 1973; and Rosch, 1973), when they were investigated, did not furnish an appropriate means of assessing comprehension.

These authors discussed two approaches to meaning: the first directed to the attributes of whatever is named by the word, and the second to the notion of typicalness or centrality: that is, one's concept of anything centres on the one of the kind which represents for this individual the conventional example.

A third approach was more relevant to this present study. Dale (1976) referred to it as the relational

approach, which, he pointed out, in the case of the word "cat," would also demand some relationship to be specified, such as, "cats chase mice, are chased by dogs, eat meat, and so on [p.174]."

Sampson (1975) examined meaning from another perspective:

> Statements about the "meaning" of a sentence are statements, not about the properties of that statement itself, but about the relationships of *inference* which hold between that sentence and the other sentences of the language (p.140).

And some years earlier, Deese (1958) wrote:

> Suffice it to say that the prevailing view in psycholinguistics today is that meaning has its roots in association. The meaning of a word, a phrase, or any kind of verbal unit is determined by the associations of that unit with other verbal and nonverbal responses and with external stimuli generally. Meanings, indeed, seem frequently to be little more than a bridge between one associative cluster and another (pp.331-332).

These statements stress the meanings attached to various structures of language, as critical elements in

comprehension; and Deese (1958) specifically gave to meaning the task of reconciling what may not always be convergent views.

Meaning is usually associated with the semantic-pragmatic component of language, but Dik (1978, 1983) emphasized a view now closely associated with generative semantics that in a sentence the syntactic component is inevitably invested with meaning.

In *Advances in Functional Grammar* (1983), he wrote:

> In the Functional Paradigm, syntax cannot be regarded as autonomous with respect to semantics. Rather, the very essence of syntax is that it provides the means of creating meaningful expressions (p.1)

Concerning Reading Comprehension

It is now possible to appreciate the point of view attributed to Deese (1958). There is no limit to the relationships and levels of understanding that may be specified by anyone wishing to test the comprehension of some other person. One may ask for the results deriving from a particular action, or for the significance of particular characters in a narrative, and to explain the various inferences that may plausibly be drawn from actions than have occurred. At the highest level, it is also possible to

demand feasible alternative solutions to any problem that has been presented.

The above levels of understanding may be seen as the essence of a reading comprehension test; and Davis, in 1941, in an unpublished doctoral dissertation, gave the results of his survey of the operational skills thought to be the essentials of reading comprehension. They are:

(a) Remembering word meanings;

(b) Selecting appropriate word meanings in the light of context;

(c) Following the organization of a passage, as in identifying antecedents and references;

(d) Identifying the main thought of a passage;

(e) Answering questions for which explicit answers are required;

(f) Weaving together the ideas in a passage;

(g) Drawing inferences about the content of a passage;

(h) Recognizing literary devices and identifying the author's tone and mood;

(i) Drawing inferences about the author's purpose and point of view.

Davis ascertained that of these characteristics, the ability to associate word meanings in a correct fashion is paramount, and a capacity for logically associating ideas and from the patterns making inferences, or going, as Bruner

(1973) has suggested, "beyond the information given [pp.218-238]," is next in importance.

An Analytical Approach: *Comprehension*

The work of Kintsch (cited in Crowder, 1982, pp.127-143) supplements this brief discussion of meaning and the approach which led to the adoption of the *Davis Reading Test* in this present research study.

Kintsch asserted that all personal knowledge can be identified as either abstract concepts, which have no particular correspondence to words, and consequently are not a prime concern of reading comprehension in the present context, and word-concepts, which obviously do. These latter define the lexicon used by the individual, and they may be combined to form "propositions," which are essentially the predicates of sentences and one or more "arguments," or the subjects of sentences and the phrases and so on that do not form part of the predicate.

A sentence may require several propositions if its meaning is to be fully conveyed. the following example illustrates this point:

(love, the, Greeks, art) & (beautiful, art) & (when, (conquer, Romans, Greeks), (copy, Roman, Greeks))

These propositions generate the following sentences:

(a) The Greeks loved beautiful art. When the Romans conquered the Greeks, they copied them.

(b) Beautiful art was loved by the Greeks. The Romans copied the Greeks when they conquered them.

The order in which the various propositions are used is hierarchical. The perceived central proposition is first, and the repetition of any arguments from the first propositon are accorded second rank. The third level is assigned to arguments repeated from the second level, but not to any from the first.

The relationship between adult reading and the representation of material in this way is illustrated by the fact that two reading texts can be substituted for the same propositional text, as is illustrated in (a) and (b) above, but the reading texts may differ in terms of grammatical complexity. This relationship is well illustrated in the *Davis Reading Test*, with its paragraphs, graded for syntactic complexity as well as for content. Research (Crowder, 1982; Kintsch & Keenan, 1973) has shown that there is a strong dependence of reading times on the number of propositions, and the complexity of the text affects the

ease with which the reader translates the subject-matter into the propositional format. However, once this has been achieved, the original layout does not influence subsequent analysis.

In making inferences, which is a feature of the *Davis Reading Test*, the tranferring of the information from print to the reader's mind is only the first operation. The second essential is to relate what is read to the reader's prior experience. Moreover, individuals draw inferences that are implied in the text, irrespective of how the propositions are stated (explicitly or implicitly). It has also been ascertained that for a brief time after a sentence has been read, there is verbatim memory for that sentence, but without too much delay, a more abstract form of memory must be the source of any recall.

Assessment: *Mental Ability*

Selected Theories of Mental Ability

Theories of mental ability fall into three main groups, and their authors or disciples have demonstrated the theories in tests which are claimed to measure the construct in people of all ages, levels of education, and cultures. One should observe, however, that Sternberg (1986) doubted that comparing levels of intelligence across socio-cultural

groups was other than extremely difficult and may be impossible, which seems to imply that the assessment of intelligence for selecting personnel is not a valid procedure unless the examiner has ensured the homogeneity of the sample.

The earliest theorists were pragmatists. Binet (1905) regarded intelligence as a group of faculties, such as judgment, practical sense, initiative, and the ability to adapt to change. Wechsler (1939) stated that intelligence is revealed by what it enables the individual to do, which includes not only the ability to perform single tasks, but also that of combining skills in various ways. He added that, while one can measure aspects of mental ability by means of tests, care must be taken not to assume that the resulting scores are full representations of what intelligence really is.

The second group of theorists set out to discover the nature of mental ability through factor analysis. There were those who postulated a general factor which underlies all intellectual endeavour, and others who subscribed to a multiple-factor approach of one kind or another. Inevitably, both schools of thought have modified their approaches with the passage of time. Spearman (1927) Burt (1949), and Vernon (1950) favoured a powerful general factor, which Spearman associated with two cognitive abilities: the *eduction of*

relations (determining the relationship between two or more ideas) and the *eduction of correlates* (finding a second idea that is associated with one previously stated). Spearman and those associated with his views recognized that group and individuals factors could also be extracted.

Thorndike (1927) and Thurstone (1938) opposed the hierarchical models of Spearman, Burt, and Vernon, preferring instead to recognize many different abilities, without assigning special significance to any one of them.

The most influential proponent of the multiple-factor theory was Guilford (1967, 1973), who developed a *Structure of Intellect* model, comprising five types of *Operation* (cognition, memory, divergent production, convergent production, and evaluation), four types of *Content* (figural, symbolic, semantic, and behavioural), and six types of *Product* (units, classes, relations, systems, transformations, and implications), which together yield 120 (5x4x6) available combinations with which to characterize mental operations.

Guilford has related his factors to individual items in two of the Wechsler batteries (WISC-R and WPPSI-R), and one may assume that this detailed analysis, as far as the factors in these two batteries are related to those of the *Wechsler Adult Intelligence Scale-Revised*, enhances the value of this scale by revealing what actually is being

assessed by each sub-test.

Guilford was not impressed by the innovative theory of "fluid intelligence" and "crystallized intelligence" proposed by Horn and Cattell (Cattell, 1963; Horn & Cattell, 1967; Horn, 1985). He strongly criticized the concept as being the outcome of faulty factor analysis, specifically the inadequate selection of primary mental abilities and the unsystematic and biased sampling of these abilities and of the subjects participating in the study. He also questioned the attempt to allot a large number of primary abilities to only two higher-order factors.

Gustafsson (1984), more recently, saw fluid intelligence as a form of general intelligence, and crystallized intelligence as essentially representing a narrow dimension of knowledge, and one much less applicable to problem-solving and learning than is fluid intelligence.

This quite severe criticism notwithstanding, the concepts of "fluid intelligence," as representative of the ability to adapt and to learn new material through the operation of various mental abilities, and "crystallized intelligence," as significantly involving well-established cognitive functions and cultural forces, are valuable sign-posts, so to speak, in the pursuit of a tenable definition of mental ability.

The third group of theorists approached intelligence

through the study of information processing models (Das, 1972; Das, Kirby, & Jarman, 1975; Jarman & Das, 1977; Sternberg, 1986). These models recognized various processes. Das and his co-authors, in particular, proposed two processes (simultaneous and successive). In the first mode, stimuli are viewed simultaneously for the purpose of making a decision; and in the second mode, they are dealt with in sequence. Past experience and the demands of the task to be accomplished will determine for the individual which mode is adopted. In effect, intelligence is seen as the ability to use information obtained in one or the other way as the basis for planning behaviour which will achieve the desired objective. Raven's *Progressive Matrices* (1977) and the *Test of Nonverbal Intelligence* (1982) illustrate simultaneous processing, and tests which call for the exercise of auditory and visual short-term memory, sequence-dependent tasks, and the recognition of temporal arrangements are based on successive processing.

Current theories of intelligence tend to be critical of Guilford's model (Eysenck, 1967; Horn & Knapp, 1973; Vernon, 1965), chiefly because it does not acknowledge the hierarchical nature of the data from modern intelligence tests. This hierarchy appears to be a constant in intellectual activity, and it suggests a common or central factor underlying such endeavour. Further, most of

Guilford's factors can be accounted for by a general factor or several group factors (Vernon, 1965), and a significant number of factor-analytical studies since the publication of Guilford's model have not supported his views (Horn & Knapp, 1973).

First Developments in Testing

Success with the original *Alpha* and *Beta* tests (Yoakum & Yerkes, 1920) encouraged the development of other instruments for adults. In 1939, David Wechsler produced a battery of tests by which to assess the mental capacity of adults committed to a mental hospital. This battery was the *Bellevue Intelligence Scale*.

Wechsler (1939, 1981) defined intelligence as "the aggregate or global capacity of the individual to act purposefully, to think rationally and to deal effectively with his environment [p.3]."

This definition was in the tradition of Spearman (1927), as were the rationales of other theories by Burt (1949) and Vernon (1950), who were the British investigators, and those of Holzinger and Swineford (1937) and Thurstone (1938), among many others in the United States. Wechsler's tests were built upon foundations supplied by Binet (1905), Healy and Fernald (1911), and Yoakum and Yerkes (1920), to name but a few. In short,

Wechsler did not invent a new way of testing; he attempted to improve a series that had already done yeoman service. Undoubtedly, there are more improvements to come.

There is no doubt that Wechsler's tests measure cognitive-intellective functions. However, Frank (1983) stated that, in the relative scarcity of appropriate research, one may wonder which cognitive functions, exactly, the sub-tests do measure. There is research to suggest that they assess three cognitive factors only: a verbal factor, numerical ability, and spatial relations. (Cohen, 1952; Davis, 1956; Guertin, Ladd, Frank, Rabin, & Heister, 1966; Silverstein, 1969). Frank, (1983) considered such sampling very poor in relation to the nine primary mental abilities mentioned by Thurstone (1938). Further, the sub-tests, according to factor analysis, are not sub-tests of unique functions. Frank (1983) stated that:

> [The] subtests are factorially complex with some cognitive/intellective functions being measured by several subtests and one subtest measuring several cognitive/intellective functions simultaneously (p.119).

Such criticisms have prompted many trials with abbreviated forms of the Wechsler scales, and the most remarkable finding concerns the high correlations that have

been found between the *Full Scale IQ* and almost any combination of sub-tests (Frank, 1983; Wolfson & Bachelis, 1960). These combinations involve Wechsler's *Vocabulary Subtest*, particularly, but they include also a selection of the non-verbal sub-tests (Satz & Mogel, 1962). A situation of this kind certainly prompts questions about proxy variables and redundancies (Wildman & Wildman, 1977).

Attractive as abbreviated forms may be on the grounds of economy of time, one should realize that the correlations are derived from group data, and should be used in the case of individual protocols only with great reserve.

Later Developments in Testing

During the Second World War, an earlier version of Raven's *Progressive Matrices* (1977) was used successfully for the selection and placement of military personnel in Great Britain and overseas. The present version of the *Matrices* may be administered as a group test or individually, and it is largely independent of verbal instructions. Morrow and Morrow (1973) commented:

> The *Raven Progressive Matrices* was constructed around the concept that abstract reasoning was the best measure of *g*. . . . The important question remains whether the best evaluation of intellect requires such refined specificity, as advocated by

> Guilford, or whether it can be better understood in terms of a more simplistic, holistic conceptualization, as advocated by Cattell, Vernon, and Wechsler (pp.667-668).

Apart from this conceptual issue, a major objective of this instrument was to eliminate the influence that skill in language might have on performance. This becomes particularly important when various aspects of language are also variables in an assessment of abilities, which is the situation in this present study.

Clearly of the genre of "culturally-reduced" and, apparently, "language-free" tests, Raven's test presents the subject with two-dimensional figures which undergo changes from left to right according to recognized principles. The final space is left blank for the subject to insert his or her choice for the modification which will complete the progression.

Hall (1957), using as his sample patients in the United States Veterans' Hospitals, found that scores on the Raven's *Matrices* correlated 0.721 with the *Full Scale IQ* of the WAIS, 0.584 with the *Verbal IQ*, and 0.705 with the *Performance IQ*.

Coefficients of correlation between the *Progressive Matrices* and the Wechsler scales were reported by Barratt (1956), Desai (1955), Levine and Iscoe (1954), and Martin

and Wiechers (1954). These data, also taken from Frank (1983), and referring only to the "verbal-loading" tests of Wechsler, are given in Table 2.

The verbal loading which is apparent in the *Matrices*, a language-reduced test, is a also a characteristic of the *Test of Nonverbal Intelligence* (Brown, Sherbenou, & Dollar, 1982), which was the test used in the present research, and embodies essentially the same principles of construction. This verbal loading bears on Research Question 12 (See Chapter 1) and the relevant comments in Chapter 5.

There is considerable variation among these correlations, particularly between the data supplied by Desai (1955) and those by Levine and Iscoe (1954). With respect to the *Comprehension* sub-test, the range of correlations is too great for one to arrive at any consensus about the various relationsips that may exist.

Table 2.

Correlations: Wechsler's *Scales* and Raven's *Matrices*

Wechsler	Barratt (1956)	Desai (1955)	Levine & Iscoe (1954)	Martin & Wiechers (1954)
Full Sc.	0.75			0.91
Inform.	0.59	0.37		0.47
Compre.	0.08	0.57	0.21	0.70
Simila.	0.59	0.62		0.62
Arith.	0.54	0.65		0.66
Vocab.	0.56	0.38	0.48	0.73

These data suggest, though only in general terms, that "language-free" may not be an entirely accurate categorization for the *Progressive Matrices* and, perhaps, for any other test constructed along similar lines. Table 2, then, should not be accepted as strong evidence of a consistent relationship between verbal and performance tests. These latter tests have a significantly reduced language content, and there is little risk of multicollinearity among the language and mental ability variables.

Assessment: *Information*

The main purpose here is to consider a method of grading the written responses of adults to issues of general interest. This grading scheme should differentiate between mature and immature observations and judgments, and yield measures which are susceptible of statistical treatment.

A recognized method of achieving this end is the scheme developed by Schroder, Driver, & Streufert (1967), for the assessment of individual and group behaviour in differing social situations. These authors make a comprehensive examination of how people, in both groups and as individuals, process information of all kinds. This present research is restricted to verbal information obtained or produced as the reaction to one of several verbal stimuli with accompanying collage.

There are two ways of considering information, whatever its source or stimulus. Schroder et al. (1967) referred to "content variables," which furnish information about "the acquisition, direction, and magnitude of responses, attitudes, norms, and so on [p.4]." The chief concern is what and how much a person learns, and how long it is remembered, what attitudes or needs are exhibited and to what level of intensity. Schroder et al. (1967) spoke also of "structural variables," which determine how information is combined for various purposes.

The content variables suggest only a hierarchy. They are what are generated immediately by any stimulus. The structural variables are the modes of integrating information to form a coherent whole. These variables cannot be considered in isolation. Psychological characteristics, level of education, and environmental influences affect responses. Such is particularly the case when pictures or words with particularly strong emotional significance are used.

Structural variables are the essential information-processing variables, and they clearly contribute to an understanding of the dynamics that characterize inter-personal and inter-group relations. In this present research, interest is directed not so much to the individual's acceptance or rejection in a relationship, as to his or her mode of thinking and approaches to the solution of specific problems in, for instance, the political, religious, moral, and social areas. The main operational objective is to assess the interpretive complexity of this solution, as it is presented in a written passage, and to relate it to the individual's level of language ability.

Information is supplied in response to a stimulus of some kind. That which the individual perceives in the presented information is subsumed under the process

Differentiation (Schroder et al., 1967). The response may comprise a single categorical dimension or mode of thinking, such as one of the dimensions *tolerant - intolerant* or *concerned - indifferent*, or a number of dimensions, logically integrated. The number of dimensions alone is not a sufficient index of integrated thoughts. (Bower, 1969; Rokeach, 1960; Schroder et al., 1967).

The stimulus may be any of the following: antonymous adjectives, incomplete sentence stems, provocative questions, and contentious illustrations. If they generate conflict, discomfort in the presence of ambiguity, and a drive toward controlling others, the responses are likely to be the more revealing of the levels at which the subject deals with information.

The Schroder scale, which is the basis of the scoring described in Chapter 3 of this study, can be applied to responses generated by (a) incomplete sentence stems and (b) incongruent adjectives that are used to characterize individuals, and to (c) answers to examination questions that are offered for assessment (Claunch, 1964; Schroder & Phares, 1965). In this present research, the type of stimulus is a variant of (a) and (c), and presents a selection of controversial questions, supported by appropriate illustrations. The Schroder process *Discrimination* embraces the ability to distinguish among

stimuli.

Of the three processes *Differentiation*, *Discrimination*, and *Integration*, it is the third term that applies most directly to the assessment of the variable *Information*, as it is defined in this study.

Schroder et al. (1967) supplied a scheme for scoring the structural properties of verbal responses which is based on levels of cognitive integration. These levels are described in a series of paragraphs.

Bower (1969) classified the "Schroderian rules that determine integration level as categorical, conditional, comparative, or relational [p.12]." The lowest level of integration belies the term, for the result is only a hierarchy of dimensions. At the next level, comparisons are acknowledged and show up as alternative resolutions, which at the third level are considered jointly in a more complex relationship. The fourth level expresses a fully integrated response. These four levels are expanded to seven in the complete scale.

In connection with this scale, Bower (1969) has confirmed that "highly complex individuals" are able to deal successfully with a greater information load than are simpler individuals, and tend to delay a decision if there is likely to be more information available. Karlins (1967) and Sieber and Lanzetta (1964, 1966) also asserted that the

highly complex individual considers more alternative possibilities as solutions to a problem than do those who have difficulty in dealing with abstract concepts.

While these findings seem to be eminently sensible, one may still caution that although cognitive complexity appears to be measurable as an individual attribute, it has not been shown to be as general a trait as the literature has sometimes suggested it is. However, the deficiency here may be with the type of instrument available for measuring it. Scott (1963) and Vannoy (1965) anticipated Schroder et al. (1967) in reaching this conclusion and in recognizing that tests of cognitive complexity may not correlate highly with each other because the construct is domain-specific rather than general. Gardiner (1968) followed Vannoy in preparing a factor analysis of a number of complexity tests, and found that the main factor extracted accounted for only 11.3 per cent of the total variance (*cf* Vannoy, 1965: 13.2 per cent). In using tests claiming to quantify cognitive complexity, one perhaps succeeds only in casting doubt on its existence as a comprehensive factor.

These criticisms, however, are levelled in connection with the use of standardized tests of complexity constructs, and they have been employed chiefly to confirm the conclusions apparent in the results generated by the *Paragraph Completion Test* (Schroder et al., 1967). This test

requires the subject to make responses, three sentence in length, to each of six sentence stems. The task is to be completed in ninety seconds.

There is always the risk of distortions when projection tests requiring speed are employed. The time-limit for the *Paragraph Completion Test* places a premium on quick resolution and closure, and these ends may be achieved either by means of responses that reveal a strong personal bias and little objectivity or by conditional statements which resolve nothing.

Although cognitive complexity is an issue in the present study, its all-embracing nature as a recognizable construct is not. Here, the opinion and judgments expressed in paragraphs of "free-writing" are crucial. The Schroder scale (Schroder et al., 1967) is the product of considerable research into the reactions of individuals in a series of social settings (Harvey, 1962, 1964; Harvey, Hunt, & Schroder, 1961) It is a valid and comprehensive basis for a metric with which to assess the logical and integrative content of such paragraphs.

The Role of Memory

The role of memory in dealing with information is fundamental. Short-term memory is the immediate storehouse of new information; but mere storage is not development, and

the vast contents of long-term memory must be mined for relevant information, if new material is to be understood and used appropriately.

Here, one can appreciate the significance of selective attention, sequential processing, and relational thinking (Koopman, 1983, 1985). If any one of these cognitive processes is impaired, irrespective of the quality of short-term memory, problems can remain unresolved. For example, the individual who attempts to respond to every clue, without regard to proper sequencing and classification cannot judge when the information at hand is sufficient to resolve a question. There is a seeking for more, a willingness to embrace every source of data and in the end to become truly "the victim of spectacular information [anon.]."

Schroder et al. (1967) saw a unique characteristic of mankind as being:

> . . . not so much in the ability to use or to utilize the meanings of a large number of stimuli, but rather in the ability to learn and to utilize alternate meanings of the same stimulus and to build up and use different patterns of interrelationships within the same set of meanings (p.5).

This building cannot be achieved if the materials of

memory are available only as an unorganized stock, because the individual lacks the capacity to choose wisely and employ the constituents to some purpose.

SUMMARY

This review of the literature on grammar, syntax, reading comprehension, mental ability, and verbal information is chiefly concerned with the main variables of the present investigation. It was necessary to develop an original procedure for assessing adult syntax, but appropriate tests were available for assessing the other variables.

So vast is the literature on language, and so controversial that on mental ability, that a survey, if it is to remain coherent, must touch on only major issues. The territory on the treatment of information, as it is defined here, is much less cluttered.

In this study, the scores awarded for syntax (the variable *Syntactic Performance*) and a semantic-pragmatic element (*Comprehension*) were added to supply a score for the major language variable *Language Ability*; and in order to investigate realistically the relative significance of specific language skills and mental ability as essentials in the development of information, the scores from a non-verbal intelligence test was also made available for statistical

analysis.

The literature concerning the influence of demographic variables on various human capacities is extensive. For the purposes of this present research it was sampled quite selectively, for this type of variable was not a prime issue. The canonical analytical procedures were a means of judging the influence of a particular set of variables on a second set. The intention was to "screen" for a related effect, not to predict an anticipated outcome. Had there been a highly significant dependence of one set on the other, the literature would have been explored further, and such exploration would possibly have led to a more exhaustive analysis than is furnished by canonical correlation procedures.

CHAPTER 3. METHODOLOGY

Ad eas res conficiendas

VARIABLES: CHARACTERISTICS AND SCORES

The major variables in this investigation were:

1. *Language Ability* (representing the combined score for *Syntactic Performance* and *Comprehension*).
2. *Syntactic Performance* (comprising *Score for Verbs*, *Variety of Clauses* and *Elaboration of the Subject and Predicate*).
3. *Comprehension*
4. *Mental Ability*
5. *Information*

There were, in addition, demographic variables pertaining to the subjects. These were *Age*, *Socio-economic Status*, *Education*, and *Occupation*, and their effect on the language variables was examined by means of canonical correlation analysis.

The choice of these variables is discussed and defended in Chapter 1, in relation to the research studies of Hunt (1977), Koopman (1983, 1985, 1988), and Schroder et al. (1967). The allocation of scores derives from the investigations of Chomsky (1957a, 1965), Crystal et al. (1976), Fillmore (1968), Hunt (1965, 1977), Lee and Canter (1971), Strang (1962), and Tyack and Gottsleben (1977).

THE POPULATION AND SAMPLE

The target population in this research comprised men and women, aged 20 - 60 years, who were employable. A volunteer sample of 110 potential candidates was approached, but six candidates did not wish to proceed beyond the initial contact and explanation. Of the 104 who remained, four had significant difficulty in completing all the tests, and their scores were incomplete. The final 100 subjects met the demographic requirements stated above. Approximately 10% were from immigrant families, but their first language was English. They represented a full range of the categories of employment available in the Greater Vancouver Regional District. These categories are listed in this chapter (**Schedule of Scores: Demographic Variables**), as are the ages represented. This researcher encountered some difficulty in obtaining the desirable number of subjects in the middle-aged and older groups. Sensitivity about being tested and reticence in general were characteristics of these older subjects. The sample, then, is a group of volunteers drawn from an accessible population. As such sampling bias may affect both the internal and external validity of the study, the results should be interpreted with this possibility in mind.

The 100 subjects were drawn from the following sources:

A Professional men and women, managers and proprietors, fire service personnel, bank and clerical staff (total=24).

B Students attending community colleges, but also employed (total=65).

C Pre-employment Centre: Job preparation (total=11).

Information on the current educational standard achieved by the subjects in this research was in general supported by the staff of a community college or centre and, in the case of subjects listed under Source A above, from personal records or the requirements of their employment.

Indices for skewness and kurtosis in the distribution of the sample are reported in the appropriate demographic table.

Exclusions

The exclusions were: individuals who were so impaired mentally, in sight, hearing, or emotional health as to be considered, by conventional standards, unsuitable for testing, and immigrants whose first language is not English.

THE TESTING SESSION

The Subjects

The subjects were tested individually and in groups made up of three or four sections of not more than six subjects each. Where there were several groups in the room (as in a community college class), the class instructor remained in the room, and assisted with the distribution and collection of tests.

The Testing Session

The time allocated to testing was 60-70 minutes, but most subjects were able to complete their work in 60 minutes. The *Davis Reading Test* (1962) was the only instrument with a specified time-limit (20 minutes for the comprehension section). In the *Test of Nonverbal Intelligence* (1982), all subjects attained their "ceiling" score within 20 minutes. The balance of the time was allocated to free-writing, as a test in *Syntactic Performance* and as a means of assessing the variable *Information*. The researcher and, in group settings, the class instructor also, checked each group and the time being spent on each of the tasks.

Administration

The researcher introduced each test by explaining the type of response required; but, in general, the design of the test indicated this, and there was little need for clarification of the researcher's initial explanation.

The researcher's instructions for obtaining a language sample are contained in Appendix D. These instructions were read out to the subjects. Examples of typical responses are supplied in Appendix H.

Confidentiality

During a preliminary visit, or immediately before the testing session, subjects selected a numbered set of five pages, comprising Form AEH *How We Understand Information and Make Decisions* (See Appendix B), Form BEH *Personal Information* (See Appendix C), a blank sheet for free-writing, a response form for the *Davis Reading Test*, and one for responding to the *Test of Nonverbal Intelligence*. A detachable portion of Form AEH contained an *Agreement*, which the subject signed to confirm his or her agreement to be tested, and an *Acknowledgment*, which the researcher signed in recognition of the subject's agreement to take part. Once these forms had been exchanged, they were separated from the numbered set. This ensured that signatures were not used for the identification of test

response-sheets.

Post-test Visits

Once the responses were scored, the researcher returned to the individual or group, and gave each subject the opportunity to discuss his or her results.

INSTRUMENTATION AND PROCEDURES

Selected Procedure: *Syntactic Performance*

This researcher re-analyzed the language samples of Koopman's subjects (Koopman, 1988: N=89), and found that the order of frequency of use was comparable with that recognized in the literature as the pattern for developmental language (Crystal et al., 1976; Lee & Canter, 1971; and Tyack & Gottsleben, 1977). Justification for accepting frequency of use as a measure related to complexity is to be found in Zipf (1949). The assessment procedure presented here is based on the re-analysis mentioned above, but in its present form is original. The verification of its validity and reliability is discussed below, in this chapter.

The scores in each category constitute an hierarchical (ordinal) scale. The essence of the scoring is accordingly the preservation of an order, particularly between compound

and complex sentences.

Hierarchies based on ordinal scales are a common feature of syntactical scoring schedules, although the categories of structural forms to which the hierarchies are applied may vary with the objectives that the investigator has set. Lee (1974), Lee et al. (1971), and Tyack et al. (1977), all concerned with the development of language from infancy, and the indications of later impairment in the developmental process, apply rank to various types of pronouns, to main and secondary verbs, to negatives, and to questions. By means of this analysis, they incidentally apply rank to the various clauses and phrases embodying these elements. Hunt (1977), being more concerned with language after the developmental period in childhood, moves directly to clauses and phrases.

The allocation of scores in these hierarchies implies relative position on a scale designed to preserve this position or rank, and, as indicated above, the schedules for the variable *Syntactic Performance* in the present research are meant to serve the same purpose. This having been said, one still has to determine the criteria for the award of a particular score.

It is clear that systematic observation and the recording and analysis of spoken language from subjects at all ages has been the only source of data on which to build

developmental patterns for language. From these patterns, a consensus representing the norms at each age level has emerged. These norms have enabled one to claim that the developmental sequence for language acquisition during the first years of life is invariant, and can serve as the basis for the identification of linguistic impairment.

In the case of adults, a similar process of recording and analysis enables one to identify the forms and usages that are the accepted norms for particular societies. The question then arising concerns the justification for applying scoring schedules that were originally designed for the assessment of childhood language to adults.

Crystal et al. (1976) stated that current linguistic theory has no coherent theory for syntactic complexity, and that intuition is a questionable basis for making any decisions in this regard. They then assert, on the evidence of clinical experience, that in analyzing adult language, it is acceptable "to order syntactic structures in terms of the normal developmental sequence of the child [p. 28]," but add that they have no theoretical reasons for this procedure, and take refuge in pragmatism because "we have found no viable alternative, and by using it satisfactory progress progress . . . has been achieved [p.32]."

Similar reasoning and the outcomes thereform guided this researcher in the development of his schedules, which

are set out in the following pages. One is inevitably influenced by Chomsky (1957a: p.111) in this type of endeavour, although, as stated in Chapter 2, attempts to apply his order of transformations directly as the means of judging language have proved disappointing. Nevertheless, Lee (1974: p.143) stated that her scheme of verb elaboration can best be understood by reference to Chomsky's analysis, and the schedules, particularly those for verbs and the elaboration of the subject and predicate, reflect his obligatory and optional transformations.

Clinical experience and teaching and the general principle of frequency of use (*cf.* Zipf, 1949) exercised significant influence, but the schedule applied to the scoring of verbs was derived, in the main, from Lee et al. (1971), and those applicable to the variable *Variety of Clauses* and *Elaboration of the Subject and Predicate* are based on the work of Hunt (1977).

The "once-only" award of eight marks for the first use of a complex sentences (a main clause with an attached or embedded subordinate clause) acknowledges the usefulness of such a device as the "sentence-point" (Lee, 1974). This "once-only" score ensures that the complex sentence will always receive more credit than the compound sentence (two co-ordinate clauses plus a conjunction), and reflects Hunt's finding that co-ordination precedes subordination in

developmental schemes (Hunt, 1977: pp.95-97).

Allocation of Scores: *Syntactic Performance*

Score for Verbs

The present tense of any verb is the stuff of everyday language, and few people encounter verbs so exotic as to be incomprehensible to a native speaker of the language. Emphatic forms in the present tense and questions appear to have little discriminating power, and consequently do not attract a score.

Credit is given for the past tense of most verbs (simple, progressive, present perfect and emphatic forms in the past tense). The two exceptions are the past tense of the verbs *to be* and *to have*, which are not allocated a score. Here again, these forms have little discriminating power. The more complex forms of these two verbs, however, are marked similarly to all other verbs (Scheffer. 1975).

The pluperfect tense (simple, progressive, and emphatic) is awarded a score on the basis of its greater complexity, particularly in a sequence of tenses, as compared with the simple past forms.

Implying future time appears to give significant trouble to subjects who are asked to make changes from some other tense and use *shall* or *will*. More often than not,

these forms give way to such alternatives as the use of the present tense with modifiers ("I am going to visit him tomorrow," or even "I see him next Tuesday") in which instance the phrase "next Tuesday" is the sole indicator of future intent.

The form most often used to imply future time is the present progressive tense of *to go* and the infinitive of the action-verb ("I am going to sing.") This form and that which adopts the *shall* and *will* construction are scored lower than the forms with the present tense and a modifier. ("I leave next week").

The future perfect tense ("I shall have proved" and "I shall be proving") falls within the range of complexity exhibited by the pluperfect or the past perfect tense, and is scored accordingly. Verbs in the conditional moods are scored similarly to *shall* and *will* as recognition that a conditional element is implied in the context of time in particular contexts.

Variety of Clauses

Sentences are classified in three categories: simple, compound, and complex. The simple sentence comprises a simple or compound subject and a finite verb. It may contain a complement, direct object, or an indirect object, or a combination of any of these. The subject and the predicate

(the verb plus objects, direct and indirect) may be modified by phrases, which can be regarded as a form of elaboration.

The compound sentence is a combination of two simple sentences, joined by a co-ordinate conjunction, with the subject common to both sentences suppressed in the second sentence, as in:

NP-Verb+Options+Co-ord Conj +Ø-Verb+Options

It is essential that the second subject slot remain empty. It must not be filled by a pronoun. If the subject slot is filled, two simple sentences are created.

The complex sentence comprises a main clause and a subordinate modifying clause embedded or attached to the main clause, as in:

adverb-np-verb+options-NP-VERB+OPTIONS

where the lower-case letters and upper-case letters, respectively, represent the subordinate and main clauses.

There may be reversal of the order of the subordinate and main clauses; or the embedding of subordinate clauses, as in this pattern:

NP-pronoun-verb+options-VERB+OPTIONS

The categories of subordinate clause represented are:

(a) Noun clauses as object

(b) Adjectival clause

(c) Adverbial clause of time

(d) Adverbial clause of reason

(e) Adverbial clause of condition

(f) Adverbial clause of place

(g) Adverbial clause of manner

(h) Adverbial clause of comparison

(i) Adverbial clause of consequence

(j) Other adverbial clauses

(k) Noun clause as subject

Whatever the category of subordinate clause used, a supplementary score is awarded in addition to the categorical score. This supplementary score ensures that more credit is always given for a complex sentence than for any compound sentence. No compound sentence receives this credit.

Any use of the passive voice receives credit on the basis that, in a syntactic structure, it signals greater complexity than does the conventional pattern of NP - V - NP.

Elaboration of the Subject and Predicate

Elaboration or embellishment is the third major division in *Syntactic Performance*, and has already been referred to in connection with the study by Hunt (1977). This feature is designed to give credit for the use of language which may not exhibit a great variety of

subordinate clauses, but is still deemed to be of superior quality on account of its wealth of phrasal and other structures that enhance the descriptive power and impact of the sentence. The items that make up this form of elaboration are listed in the appropriate schedule below. No credit is given for adjectival or adverbial "strings" such as "big, strong man" or "persistently, inexcusably rude."

The selection of the nature of the verb, clausal structures, and modifying devices as characteristics through which to measure syntactic maturity is supported in the literature listed above.

Reliability and Validity: *Syntactic Performance*

The reliability of this assessment of *Syntactic Performance* was examined by means of a split-half coefficient in a pilot study (N=89), using data (individual sentences and paragraphs) supplied by Koopman (1988): Cronbach's *alpha* = 0.75.

In this instance, Cronbach's *alpha* is a measure of the internal consistency of the test, and gives the lower bound for the reliability of the whole test. Thus, one recognizes that the various "splits" were not necessarily τ-equivalent (Allen & Yen, 1979).

> [τ-equivalent tests are tests which satisfy the following criteria: (a) an observed score comprises the true score plus error score; (b) the expected

value (the population mean) of the observed score is the true score; (c) examinees with high true scores do not have systematically more positive or negative errors of measurement than do examinees with low true scores; (d) the error scores on two different tests are uncorrelated, *i.e.* if a candidate has a high positive or negative on one test, he or she is not more likely to have a high positive or negative score on a second test; (e) the error scores on one test are not correlated with the true scores on another test].

If, in addition to (a) to (e) above, the true scores of one test are equal to the true scores on the second test, and their variances are equal, the two tests are then parallel tests, and one can be confidently substituted for the other without adjustment.

The data for assessing the reliability coefficients in the pilot study were derived from written and oral (later transcribed) material, and the "splits" were analogous to those obtained in the constituent questions of the conventional test. In this present research, the material was scored for only the quality of verbs, variety of clauses, and phrasal embellishment. The format (a paragraph or several paragraphs) cannot be adapted for a split-half procedure. For this reason, and because the subjects in this research were adults who were not available for re-testing, establishing the reliability of the method of assessing *Syntactic Performance* has depended on the reliability associated with each of the elements constituting this variable (verbs, clausal variety, and phrasal embellishment)

in the pilot study conducted with Koopman's (1988) data, and on the inter-rater reliability achieved in this present investigation. The correlation between the scores given by this researcher and those awarded by an independent examiner, who re-assessed one-third of the language samples, was 0.80 ($p<0.05$).

Content validity for the method of assessing the syntactical quality of a passage in Koopman's (1988) study was established by the logical examination of the domain which it was desirable to represent, and the procedure for scoring *Syntactic Performance* was further refined for this current investigation by the addition of phrasal structures omitted in 1988. It is believed that these additions have helped to ensure a just and realistic assessment of this component. A factor analysis of the present scores for *Syntactic Performance* confirmed the independence of three orthogonal factors and of three independent methods of scoring the elements of this variable.

All language samples were also scored in *Minimal Terminable Units* (Hunt, 1965). This approach is well-established as a means of judging maturity of language. It furnishes a quantitative measure which, *prima facie*, suggests a general level of competence in language. The emphasis in this present study was much more on the quality of certain syntactic constructions (quality of verb and

clausal and phrasal variety), which the T-unit does not specifically reflect. Consequently, the T-unit was employed as a supplementary assessment and external criterion, but the individual scores pertaining to the T-unit analysis are not included in Chapter 4. The correlation between the scores for *Syntactic Performance* and those for assessment in T-units was $r = 0.68$ ($p<0.05$).

Procedure for Scoring

A systematic approach to the marking of the language samples is set out below. Steps 1 - 7 should be completed in sequence for each sample.

1. Count the total number of words in the sample, including repetitions.
2. Underline all finite verbs, and identify tenses.
3. Bracket all simple sentences, not parts of compound or complex sentences.
4. Bracket all compound sentences.
5. Bracket all complex sentences, and identify category (see schedule).
6. Identify all examples of elaboration (see *Elaboration of the Subject and Predicate* below).
7. Allocate the appropriate scores and list them at the end of each language sample under *Score for Verbs*, *Variety*

of Clauses, and *Elaboration of the Subject and Predicate*.

Schedule of Scores: *Syntactic Performance*

Score for Verbs

- Score 1. Future implied by the progressive present tense of *to go* and the infinitive of the primary action or state. Future implied by *shall* and *will*. Conditional mood of all verbs.
- Score 2. Future implied by present tense plus modifier.
- Score 3. Past tense: regular and irregular (simple, progressive, present perfect, and emphatic): all verbs except *to be* and *to have*.
- Score 5. (a) Subjunctive mood of all verbs; (b) pluperfect tense (simple, progressive, and emphatic) of all verbs; (c) future perfect tense (simple and progressive) of all verbs; (d) all passive voices of all verbs.

Variety of Clauses

- Score 1. Simple sentence: simple or compound subject with finite verb, with or without elaboration.
- Score 5. Compound sentence: simple or co-ordinate subject, with a finite verb in each co-ordinate

sentence; the subject slot of the second sentence left empty.

- Score 1. Subordinate noun clause as direct object or complement.
- Score 2. Subordinate adjectival clause.
- Score 3. Subordinate adverbial clause of time.
- Score 4. Subordinate adverbial clause of reason.
- Score 5. Subordinate adverbial clause of condition.
- Score 6. Subordinate clause of (a) place, (b) manner, (c) comparison, (d) consequence, (e) other subordinate adverbial clause.
- Score 7. Subordinate noun clause as subject.
- Score 8. A supplementary score is given once only at the first use of any subordinate clause, but not for any subsequent use of the initiating category of clause or any subordinate clause in another category. This weight is NOT given for compound sentences.

Elaboration of the Subject and Predicate

- Score 1. Direct object, or indirect object, or complement. Where a noun clause as object is present, no additional weight is given for any direct object present as an integral part of this noun clause.
- Score 3. Two of direct object, indirect object, complement.

- Score 5. (a) Any inversion of the standard sentence for emphasis or special effect; (b) elaboration of the subject or predicate with appositional, prepositional, adjectival, adverbial, and infinitival phrases, other than those mentioned under scores 1 - 7 in the section (*Variety of Clauses*) above.

Selected Procedure: *Comprehension*

One may, with some justification, suggest that the "context question," based on memory and a knowledge of the whole text, called for a response which would specify the initiator of the action or state, the intention of the initiator, and its influence on other characters and events. A test in reading comprehension seemed, to this researcher, to embrace similar objectives in the area of recall as did the context question, but it should also call for an appreciation of inference and of any consequences arising from the interactions of the various characters. Such a test had to meet these criteria in the context of the present research.

1. Be appropriate to use with adult subjects.
2. Be available as a group test.
3. Be easy to administer.
4. Not require more than twenty minutes to yield a significant score.

5. Not be "restricted" with regard to those who may administer it.
6. Yield a score on an interval or a ratio scale.

These criteria were imposed by the characteristics of the sample, the limits of the time available for testing, and the statistical procedures adopted in this enquiry.

The *Davis Reading Test* (1962) met the requirements set out above, but there are criticisms of reviewers which must be taken into account. Between 1968 and 1973, four factor analyses were made of the results from various testings. Davis (1968) identified five skills in reading comprehension:

1. Recalling word meaning.
2. Finding answers to questions asked specifically or in paraphrase.
3. Drawing inferences from content.
4. Recognizing a writer's purpose, attitude, tone, and mood.
5. Following the structure of a passage.

Four years later, Davis (1972) named four factors in reading comprehension:

1. Recalling word meaning.
2. Determining meaning from content.
3. Finding answers to questions asked specifically or in paraphrase, and weaving these ideas together.

4. Drawing inferences from the content.

Spearritt (1972) applied "maximum likelihood" factor analytic procedures (Joreskög & Lawley, 1968) to data from the Davis test, and identified four unique factors:

1. Recalling word meanings.
2. Drawing inferences from the content.
3. Recognizing a writer's purpose, attitude, mood, and tone.
4. Following the structure of a passage.

Thorndike (1973), in his findings, was not as categorical as were Davis and Spearritt. In his statistical analysis, he found that one factor, which he did not explicitly identify as that mentioned by Spiro, Bruce, and Brewer (1980) below, accounted for 93% of the variance in the scores for comprehension. As verification, further sets of data were analyzed, and in each case, a single factor accounted for 80% - 90% of the variance, and the remaining variance was exhausted by two, or perhaps three, other factors. On this evidence, Thorndike (1973) decided that the several unique factors claimed by Davis (1968, 1972) were not to be distinguished. In conclusion, Spiro et al., (1980) stated that one "sees that *different analyses yielded different unique skills*, and only one skill was constant across these analyses: remembering word meanings [p.543]."

Interpretation of the factor analytic data is governed

very clearly by the procedure which is adopted.

This writer feels that "remembering word meanings" is too simplistic a description of the factor (if, indeed, there is but one) in reading comprehension. To describe the factor thus is to find in the Davis material little more than a classified vocabulary. Even a cursory examination reveals much more. The apparent single factor or skill is truly multifaceted, and in the manner portrayed in the analyses by Davis (1968, 1972) and by Spearritt (1972).

On the balance of this evidence, the *Davis Reading Test* (1962) was accepted as a suitable instrument for assessing the variable *Comprehension*.

Allocation of Scores: *Comprehension*

The authors of the *Davis Reading Test*, (1968, 1962) supply raw scores. These may be converted into percentiles by means of tables. Scores are available for level-of-comprehension and speed-of-comprehension. Level-of-comprehension is based on the first 40 items. As the subject goes on to reply to the second set of 40, he or she is gaining marks which go toward the assessment of a speed-of-comprehension score.

The test is offered in two series. The first series (1A - 1D) is stated to be appropriate for first-year college students, grade 12 and superior grade 11 students. The

second series (2A - 2D) is suitable for grades 8 - 11. Within these series are alternate forms of each series. [See Allen & Yen, 1979, on parallel forms and essentially τ-equivalent forms].

For this research, the primary interest was in the second series. A pre-testing survey of the general educational level of potential subjects suggested that Form C, Series 2 was an appropriate level. The content of the other forms, at one point or another, was too obviously juvenile for adults, but the series, as a whole, made significant demands on the adult reader.

Reliability and Validity: *Comprehension*

The reliability of the second series was assessed for grades 8 - 11 by means of the correlation of pairs of forms of the test. The sample was divided into four groups, and testing followed this pattern:

- Group 1: test with Form A and then Form B.
- Group 2: test with Form B and then Form A.
- Group 3: test with Form C and then Form D.
- Group 4: test with Form D and then Form C.

As the scores in this present research referred exclusively to adults, and were not compared with those of other age-groups, the following reliability coefficients were accepted as appropriate in this context.

The inter-test correlation coefficients were transformed by means of Fisher's *z* to supply one reliability coefficient for each score (level or speed) for each grade. The coefficients ranged from 0.77 - 0.84.

In respect of content validity, the authors (Davis & Davis, 1962) claimed that "Factorial studies have provided evidence that tests of this kind are excellent measures of verbal aptitude [p.22]." Few would deny this claim on the basis of the test's perceived verbal content, although the statistical data offered in support is not impressive. Approximately, 250 students from each of grades 8 - 11 completed the test, and the correlations between the test results and the students' mid-year grades in English ranged from 0.39 - 0.54 for level of comprehension. The correlations between the *Reading Test* and various standardized tests in English (*Otis Beta*, *Otis Gamma*, *Minnesota School Aptitude Test*, and the *Co-op Reading Comprehension Test*) range from 0.68 - 0.78 (Manual, *Davis Reading Test*, p.26)

The general validity of the *Davis Reading Test*, need not be questioned, but some researchers (Spearritt, 1972; Thorndike, 1973) have not entirely confirmed the findings and the claims made by Davis (1968, 1972).

The raw scores for level of comprehension were analyzed in this present research. The scaled scores and percentiles

supplied in the test manual are for the purpose of comparing attainment as between the different series.

Schedule of Scores: *Comprehension*

With regard to level-of-comprehension, a score of 1 is awarded for each correct response. The total is corrected for guessing, and this adjustment is achieved by deducting marks as directed in Appendix G of this study. A simple total may then be converted into a standard score (Mean=50; SD=10).

Selected Instrument: *Mental Ability*

The test with which to assess *Mental Ability* in this investigation was required to meet the following criteria:

1. Be appropriate for use with adult subjects.
2. Be available as a group test, when small groups can be tested.
3. Be easy to administer.
4. Be satisfactorily completed with short responses.
5. Not be obviously confounded by a language variable.
6. Yield a composite score on an interval or a ratio scale.

These criteria were enjoined by the nature of the sample, constraints of time, the intended statistical procedures, and the requirement that the test not have a

language component in its construction.

The *Test of Nonverbal Intelligence*, (1982) met all the criteria cited above. It was appropriate for adults of the target population (adults aged 20-60 years); it could be used with small groups and with individuals, which was the mode of attendance envisaged for this enquiry; it was easy to administer, requiring no specially-trained examiners, and the responses were simple to make. The choice of response called for the recognition of figural identities, analyses, classifications, intersections, and progressions in sequences of increasing difficulty. By definition, it was a non-verbal test; and, finally, a simple raw score was available. This could be converted into a percentile or a standard TONI quotient,

Allocation of Scores: *Mental Ability*

The allocation of scores in this test, for this research, was essentially the task of choosing the mode in which any scores were to be recorded and manipulated. Raw scores were converted to percentiles which reflected a correction for age, and these were then converted to T-scores (Mean=50; SD=10).

Reliability and Validity: *Mental Ability*

The standardization group for the *Test of Nonverbal Intelligence* was 1929 subjects from 28 states of the United States. Their ages ranged from 5-0 years to 85-11 years, and normative data were drawn from cumulative frequencies of raw scores at every interval of 6 months from 5 to 18 years, every one-year interval from 19 to 24 years, and every five-year interval from 25 to 85 years. Mayo (1985) stated:

> Some of the subgroup Ns [numbers of subjects] are shockingly small, *e.g.* as small as 10, 11, 16, and 30 for four deviant groups upon which KR21s [Kuder-Richardson formula 21] and alternate form reliabilities were computed (p.1582).

This stricture does not, however, apply to the age-ranges of interest in this enquiry.

There are two forms of the TONI, which may be considered alternate forms. (Allen & Yen, 1979). Reliability was assessed by calculating Cronbach's *alpha* and KR21 (Kuder-Richardson formula 21). The reliability coefficients reported lie in the range 0.60 - 0.92, with most above 0.80, for internal consistency in respect of both forms; and alternate forms reliability procedures yield coefficients of comparable magnitude (range: 0.78 - 0.95).

[Cronbach's *alpha* is sometimes listed as coefficient

> *alpha*, and as KR20 (Kuder-Richardson 20). KR21 is a special case of KR20. If the items in the test do not have approximately the same degree of of difficulty, KR20 will underestimate the test's reliability. Otherwise, the two indices yield similar results].

Content validity is claimed on the basis of item selection. Many of the items have been drawn from Raven's *Progressive Matrices* (1977), the *Leiter International Scale* (1948), and Wechsler's *Performance Scales*, (1939, 1967,1974). Construct validity is supported by data from a comparison of the performances of retarded and of "normal" subjects. Both the retarded and the normal subjects were children, and there were 10 retarded children. This size of comparison is really much too small for the reaching of definitive conclusions. In respect of the TONI, Brown et al., (1982) state in the Manual for the *Test of Nonverbal Intelligence*:

> For the TONI, it [concurrent validity] was established through several studies in which TONI scores were correlated with performance on a variety of measures of intelligence and achievement; Raven's (1938) Progressive Matrices, the Leiter International Performance Scale (Wechsler, 1974), the Otis-Lennon Mental Ability Test (Otis & Lennon, 1970), the Iowa Tests of Basic Skills (ITBS) (Linquist & Hieronymous, 1956), the SRA Achievement

> Series (Naslund, Thorpe, & Lefever, 1978), and the Stanford Achievement Test (SAT) (Madden & Gardner, 1972) (p.12).

Despite the limitations of some of the validation data pertaining to it, the *Test of Nonverbal Intelligence* furnishes scores which are comparable with those from other intelligence tests, and the defects in the validation procedures will undoubtedly be compensated for as the test continues to be used. The conclusions of Mayo (1985) are significant:

> In summary, the TONI appears to have been moderately well developed psychometrically. It has face validity for the non-verbal purpose which is intended. The items are well scaled in difficulty and psychological complexity. The main weaknesses found or suspected by the reviewer occurred in the incompleteness and ambiguity of directions, suspected possible difficulties in scoring for some examinees, too small sample sizes for subgroups (especially at the younger ages) resulting in higher standard errors of measurement, and serious lack of sufficient evidence of validity (p.1583).

Schedule of Scores: *Mental Ability*

As stated earlier, a subject's age customarily determines at which point he or she begins answering the *Test of Nonverbal Intelligence*, unless there are other circumstances which suggest the starting-point should be below the normal level. Items below this starting level are credited to the subject.

Item 20 is suggested as the level at which to begin testing the 18-20 years group. If, for any reason, this starting point is inappropriate, a basal item is sought by determining the level which represents the first of five correct responses. Testing continues until the subject fails three out of five items. Mayo (1985) drew attention to a situation which could conceivably arise with the very bright subject who can successfully respond to all items. In this circumstance, there would be no ceiling level, no third error. To this writer, the matter is not important: the TONI score could be read with the prefix "not below. . . "

One should note that a candidate who is "very old," (presumably this means "senile"), starts with the practice-group items, and a basal item is subsequently established. Item 10 was selected in this study as the basal item and this proved to be generally suitable.

Selected Procedure: *Information*

The procedure which affords the most effective means of assessing the level at which individuals generally process information is one based on Schroder et al. (1967). For this present enquiry, the stimuli for prompting responses at various levels were collages that projected issues (by headlines and illustrations) about which subjects were likely to have definite views. Illustrations of these collages (cards) are supplied in Appendix F.

The topics from which the subject was asked to make a choice were:

1. Fetus's rights *vs* mother's rights: Is there a case for abortion?
2. The United States and the Soviet Union agree to destroy medium and shorter range nuclear weapons: Should we trust either side?
3. Delinquents in school: Is getting tough the answer for delinquents?
4. Politicians' private lives: Fair game for the press? What should the press do?
5. Arms against crime: A citizen's right? Shooting in self-defence?
6. Children's toys: You call these toys? Too expensive for children?

It was anticipated that the choice of one of these

topics would prompt a sample of written composition susceptible to analysis and scoring based on the methods of Schroder et al., (1967).

In this context, Schroder et al., (1967) commented that their concern was "*how* people use conceptual structures such as attitudes for adaptive purposes [p.v]." They were less concerned with what people think. Their focus was on "Attitudes, needs, strategies, concepts, and norms [p.v]." They wanted to know how these entities were viewed and studied as structures for the processing of information.

Allocation of Scores: *Information*

A major problem was how to measure the variable *Information* with a desirable degree of statistical reliability. There are parallels between this task and the rating of any type of written or oral composition. The assumption that the marking of such material is necessarily subjective, and thus unreliable, is now questioned. The experience of reputable examining bodies has shown that reliability and consistency can be achieved in the performance of examiners, if a scoring guide and practice sessions are introduced.

The responses produced for the assessment of this variable were similar to short paragraphs, and they were scored only for content at this stage of the investigation.

In these circumstances, consistency with reference to one marker or several can be effectively aided by the use of a specification list. The degree of differentiation is largely governed by the purpose to which the piece of writing is to be put, and the items that qualify for any particular rating are therefore to be stated as unambiguously as possible. Finally, the list itself should represent a logical progression from immature to mature thinking. These are the principles on which the seven-point scale by Schroder et al. (1967) and its elaboration in the Princeton Manual Guidelines were constructed. The scheme eventually adopted for this present study is an adaptation of these guidelines.

Cooper and Odell (1977) stated:

> When raters are from similar backgrounds and when they are trained with a holistic scoring guide—either one they borrow or devise for themselves on the spot—they can achieve nearly perfect agreement in choosing the better of a pair of essays; and they can achieve scoring reliabilities in the high eighties and low nineties on their summed scores from multiple pieces of a student's writing (p.19).

Reliability and Validity: *Information*

Stalnaker (1934) demonstrated that rater reliability could be improved in the matter of judging the general quality of the composition, from a range of 0.30 - 0.75 before training to one of 0.73 - 0.98 after training. Moslemi (1975), studying the marking of creative writing, materially confirmed this finding by showing that it was possible, with three raters, to achieve a reliability index of 0.95.

The interest in, and need for, holistic evaluation prompted Follman and Anderson (1967) to investigate five different types of this approach. They reported reliability coefficents of 0.80 - 0.95, and Schroder et al. (1967) reported inter-rater reliability coefficients of similar magnitude (0.85 - 0.95) with regard to the marking of response material generated by various kinds of verbal stimuli.

Diederich (1974) complemented these studies by suggesting, as an outcome of his own research, that a coefficient of 0.80 is adequate reliability for program evaluation, but a coefficient of 0.90 is required for assessing changes in the performance of individuals.

Data of this kind can be accepted only as possible indications of what may be found in other investigations. Consequently, this researcher attempted to verify that his

modifications to the assessment schedule proposed by Schroder et al. (1967) had not violated the general principles of these authors. All responses were scored a second time according to the Princeton Manual Guidelines. The correlation between the methods was $r = 0.87$ ($p<0.05$). As a further verification, an independent examiner, using the Princeton system, checked the scores of one-third of the subjects, chosen randomly. The correlation between the scores awarded by this researcher and those awarded by the independent examiner was $r = 0.77$ ($p<0.05$).

Modification of the Princeton Manual Guidelines was achieved by the sub-dividing of levels and the consequent creation of partial scores, which offered greater flexibility in assessment. The Princeton Manual Guidelines are contained in Appendix E.

Schedule of Scores: *Information*

[The asterisk * indicates the full score. Partial scores follow].

- *Score 1.0. Presents only one side of the problem, ignoring any differences, similarities, and gradations (0.5).

  Simplistic, absolute interpretation; fast, unambiguous closure (0.5).

- *Score 3.0. One side of the problem supported much more

than any other. Opposing views perceived as negative or compartmentalized. No interrelationships considered (2.0)

Recognition of opposing views tends to be a ritual response (1.0).

- *Score 4.0. Two or more views clearly differentiated. Similarities and differences implied or presented. One view can be opposed, but is understood (3.0).

  Opposing view is recognized as a potential source of trouble, but has no bearing on eventual decision (1.0).

- *Score 5.0. Includes all involved under previous award. The subject begins to consider more deeply the similarities and differences among views. The simultaneous effects of alternative views become apparent in the respondent's thinking (4.0).

  It is realized that one view cannot be adopted without the sacrifice, to some degree, of opposing opinions (1.0).

- *Score 6.0. Considers alternative and conflicting reasons for perceived similarities and differences (5.0).

  Alternative views that are variously congruent with the respondent's own views are recognized as the ones likely to be attended to (1.0).

- *Score 7.0. Begins to consider relationships, not only

among direct similarities and differences in the aspects of a problem, but also between alternative reasons for the occurrence of the similarities and differences (6.0).

There is an awareness of the influence that the considerations mentioned above can have on any decision; this is expressed (1.0).

- *Score 9.0. Begins to consider the notions which include relational linkages among all alternative views. The notions are recognized as likely sources of the misunderstanding of motives, and there is overt expression of a desire to see all the conflicts resolved in some measure (7.0).

  Perception of conflict is now seen to be fading, and some form of reconciliation possible (2.0).

Allocation of Scores: Demographic Variables

The scores allocated to *Occupation*, *Socio-economic Status*, and *Education* reflect the "economic value" of these variables. In one sense, and to a limited degree only, the scores accorded to age-groups suggest a hierarchy of economic return to the employee: seniority usually means movement toward the top of the wage-scale. On the other hand, it is unlikely that a labourer, aged 50 - 60 years, would earn as much as a professional person aged 30 - 39

years. Hence, the age-groups may be seen as not attracting scores in such a direct way as do levels of education or, more so, occupations.

Schedule of Scores: Demographic Variables

1. *Age*:

- Score 1. 20 - 29 years.
- Score 2. 30 - 39 years.
- Score 3. 40 - 49 years.
- Score 4. 50 - 60 years.

2. *Socio-economic Status* (referring to the supporting parent):

- Score 1. Unskilled worker and labourer.
- Score 2. Service worker.
- Score 3. Clerical worker.
- Score 4. Secretary (supervisory).
- Score 5. Skilled artisan.
- Score 6. Technologist.
- Score 7. Proprietor, Manager, Administrator.
- Score 8. Professional.

3. *Education*:

- Scores 1 - 12. According to years of formal schooling.
- Scores 13, 14, & 15. According to full years of attendance at a post-secondary institution.
- Score 16. As above, (also to include a bachelor's

degree).

- Score 18. As above, (also to include a master's degree).
- Score 21. As above, (also to include a doctoral degree).

4. *Occupation* (referring to the responding individual):

- Score 1. Unskilled worker and labourer.
- Score 2. Service worker.
- Score 3. Clerical worker.
- Score 4. Secretary (supervisory).
- Score 5. Skilled artisan.
- Score 6. Technologist.
- Score 7. Proprietor, Manager, Administrator.
- Score 8. Professional.

RESEARCH DESIGN

The design presents a general multiple regression model with *Information* as the criterion (dependent variable) and *Language Ability, Syntactic Performance, Comprehension,* and *Mental Ability* as the predictors (independent variables). *Language Ability* is the criterion when its relationship to *Mental Ability* is explored (Hypothesis 12), and in the analysis concerning the multiplicative effect of *Mental Ability* and and *Language Ability* in *Information* (Hypothesis 13).

A Question of Logic

The research design for this investigation employed a single set of language samples for both syntactic analysis and the grading of opinion and argument in terms of their maturity. This situation immediately suggests the possibility of a built-in statistical bias. If one accepts the contention that there is no essential relationship between thought and language, no problem of bias arises. If, on the other hand, such a relationship is believed to exist, there may be some statistical contamination, and the bias would have to be taken into account in interpreting the results of the analysis of the data. The method of doing this in the present study is presented below, in this section.

Bolinger (1975) mentioned two metaphors which illustrate the very real dilemma presented in any discussion of the relationship between language and thought: "Talking about language is building a fire in a wooden stove" and "talking about language or science is rebuilding a boat plank by plank while staying afloat in it [p.236]."

Metaphors are an entertaining way of presenting problems, but in them precision sometimes yields to the picturesque. Here neither "language" nor "thought" is defined. Consequently, one must accept the loose concepts that these terms represent, and claim only that language is

probably the most powerful medium, among others, for expressing what is to be, and what has been learned. Bolinger (1975) added that "when we imagine we have captured a wordless thought we may be fooling ourselves—the words, perhaps are hovering in the background [p.237]."

Confirmation of this assertion is the essence of written language samples produced as the variable *Information*. The words "hovering in the background" and combined to give a series of integrated sentences are later viewed from two perspectives.

In the present research, *Language Ability* is narrowly defined by the procedures adopted for assessment. The syntactic component is represented by complexity of verb, variety of clausal elements, and forms of elaboration of the subject and predicate in examples of expressive language. The other component of this variable is represented by a standard reading comprehension test which determines skills in five categories: (a) recognition of fact, (b) grasping a central thought, (c) making inferences, (d) recognizing tone, mood, and literary devices, and (e) appreciating the structure of a passage. This test exemplifies an aspect of receptive language, and calls for ability in interpreting the syntactic and semantic-pragmatic characteristics of the material presented for analysis.

The solution adopted by this researcher, as the means

of avoiding the possibility of contaminated findings, lay in an approach in which the assessor viewed the language samples successively from two different perspectives, one in relation to discrete syntactic forms (which implies the symbolic), and the other exclusively concerned with the evidence of logical thought in a written passage (which represents a semantic framework). In this context, Bolinger (1975) has remarked "Obviously if language is to serve logic as well as poetics and pragmatics, the devices used by the logician must already inhere in it [p.238]." These devices, however, are not the nouns, adverbs, and so on seen as symbols, but the processes which they are employed to represent: "affirmation and negation, conjunction and disjunction, definiteness and indefiniteness, condition and concession [p.238]." The case now being presented turned on this distinction.

The variable *Syntactic Performance* comprised the three elements of *Score for Verbs*, *Variety of Clauses*, and *Elaboration of the Subject and Predicate*, each element viewed as an isolated static entity, although a variant of the particular concept being examined, and usually occupying one of several spaces ordained by custom and accepted usage. A verb, for instance, was viewed as an example of a particular level of complexity in the hierarchy of tenses, so to speak. It was not scored for the appropriateness of

the meaning currently bestowed on it. Clauses and forms of elaboration were similarly graded on the basis of their frequency of occurrence in adult language, or on their rating as mature constructions.

In scoring the same language sample for the variable *Information*, the perspective envisaged a more abstract system, multidimensional, and exhibiting some form of organization in time and space as the means of clarifying essential relationships (Young, Becker, & Pike, 1970). The analogy lies in regarding the variable *Syntactic Peformance* as examined for its effectiveness as a tool, and the variable *Information* for its content. Traffic lights, for example, may be examined for their quality as electrical devices, or for their suitability as the means of ensuring the smooth flow of motor-vehicles; or, to change the metaphor, the efficiency of a musical instrument does not add to or substract from the intrinsic worth of the music, but it does influence performance. These examples are parallels which suggest that when a subject's syntactic skill is measured with reference to the complexity of the structural units in a sample, and this sample is subsequently assessed on a scale which identifies various abstract qualities pertaining only to maturity of thought, there is little risk that the nature of the one grading will do anything to determine the level of the other.

One may be stirred by a mere flow of words, phrases, and sentences, which on analysis for content convey little or nothing. Similarly, great thoughts and noble sentiments may never be amply expressed, because the tools of language are blunted; but apply the full range of syntactic devices to the expression of the thoughts, and the performance is superb. However, it must now be assessed on still another scale as rhetoric.

This researcher further explored his data in an *ex post facto* procedure which involved obtaining a second language sample from approximately one third of his subjects. These samples were not based on any of the material presented to the candidates during the original collection of data in 1988.

Analysis of these second language samples and comparison of the scores with those obtained for the first samples and for the variable *Information* lend support to this researcher's contention that the scoring of any language sample will yield a consistent estimate of the individual's skill in the use of syntactical structures, and that these scores and those for the variable *Information* are derived from the assessment of totally different characteristics.

Correlations: Language Samples & *Information*

	LS1	LS2	IN
LS1	1.0		
LS2	0.8	1.0	
IN	0.6	0.5	1.0

LS1 = 1st. Language Sample

LS2 = 2nd. Language Sample

IN = *Information*

Difference between 0.6 and 0.5 is NOT statistically significant.

Difference between 0.8 and 0.6 is NOT statistically significant.

Difference between 0.8 and 0.5 is statistically significant.

The above data indicate that (a) the scoring of the two language samples yields a fairly stable estimate of syntactical skill, and (b) skill in syntax has a bearing on the quality of the solution to problems presented in the relevant language sample, but to no other, and (c) it is feasible to use the same language sample for assessing both syntactical skill and the quality of the solution to a problem without the one contaminating the other.

The main objective of this research was to explain the relationships that existed among the several variables. To be more specific, in the matter of any regression equations, one must realize that they reflect the average relationship between a criterion and each of the several predictors. Such an equation does not signify a cause-and-effect association.

Level of Significance

The level of statistical significance for testing all the hypotheses in this study is *alpha*=0.05.

METHODS OF ANALYSIS

Regular regression analysis was used to investigate the data which are applicable to the first thirteen questions and their corresponding hypotheses. In view of the controversy surrounding the partitioning of variance in non-experimental research (Darlington, 1968; Duncan, 1975; Pedhazur, 1982), a fully integrated analysis (ANOVA and MANOVA) was not desirable. Canonical analysis was applied to data which are applicable to the fourteenth question and corresponding hypothesis.

Academic and Mental Ability Variables

Hypotheses 1 - 13 expressed the substance of the corresponding research questions which are set out above, in this present chapter. The predictors (independent variables) were *Language Ability*, *Syntactic Performance*, *Comprehension*, and *Mental Ability*. The criterion (dependent variable) was *Information*.

The Demographic Variables

The fourteenth hypothesis concerned the influence of the demographic variables (*Age*, *Socio-economic Status*, *Education*, and *Occupation* on performance in the language variables (*Score for Verbs*, *Variety of Clauses*, and *Elaboration of the Subject and Predicate*, and *Comprehension (semantic component)*.

Model for Hypothesis 14

In the canonical analysis applicable here, the variables in the First Set were *Score for Verbs*, *Variety of Clauses*, *Elaboration of the Subject and Predicate*, and *Comprehension*. The variables in the Second Set were *Age*, *Socio-economic Status*, *Education*, and *Occupation*.

Statistical Hypothesis 14

The statistical hypothesis corresponding to Research Hypothesis 14 is:

Hyp. 14. $H_0: {}_{pop}R_c = 0$ $H_1: {}_{pop}R_c \neq 0$

The above statement of the statistical hypothesis implies that the population canonical correlation coefficient is not significant at the level stated and, consequently, ${}_{pop}R_c^2$ is not statistically significant.

CROSS-VALIDATION PROCEDURES

The procedure adopted for cross-validation generated a residual mean square for 50 cases randomly allocated to a screening sample, and an average squared residual for the 50 cases designated as the calibration sample. These statistics were calculated for the best sub-set of variables selected for the regression equations. They were compared. Reasonable stability of the regression equation is indicated when these two statistics are similar.

The two samples were then combined, and a regression equation was obtained for the full sample of 100 subjects. Normally, the equation for the full sample will be more stable than that from a sample of 50.

The question to be answered was:

- How stable is the relationship between the predictors (independent variables) and the criterion (dependent variable)?

The data thus generated are reported in Chapter 4.

CHAPTER 4. RESULTS

Res ipsa testis

PURPOSE AND STATISTICAL PROCEDURES

The purpose of this research study is established in Chapter 1 and emphasized in the **Research Questions** in that chapter. These questions are now re-phrased as null research hypotheses, and each appears in this present chapter immediately above the statistical table that applies. Following each of the tables are the relevant interpretation and inference of the data.

For convenience, each hypothesis and corresponding table occupies a full page, and the relevant interpretation and inference is set out on the page that follows.

The statistical analyses that generated the data in the tables which are contained in this chapter also are listed in Chapter 3.

It will be recalled from Chapter 3 that the level of statistical significance for testing all hypotheses in this study is *alpha*=0.05.

The following abbreviations are used:

LA = *Language Ability*

SV = *Score for Verbs*

VC = *Variety of Clauses*

EL = *Elaboration of the Subject and Predicate*

SP = *Syntactic Performance*

CO = *Comprehension*

MA = *Mental Ability*

IN = *Information*

AG = *Age*

SE = *Socio-economic Status*

ED = *Education*

OC = *Occupation*

VO = *Vocational Component*

Each of the tables below is followed by a brief interpretation of the content and the inference to be drawn from the data generated. The implications of these data and their bearing on this research are discussed in Chapter 5.

HYPOTHESES AND RESULTS

Each research hypothesis is followed by the corresponding table:

1. *Language Ability* (LA) will not contribute a statistically significant percentage to the variance in *Information*. (IN)

Table 3. Regression IN on LA

Variables: (a) *Information* (IN), (b) *Language Ability* (LA).

PRED.	COEFF.	S.E.	*t-ratio*	*p*
LA	0.025	0.003	9.54	<0.001

R^2 = 48.2%

Analysis of Variance

SOURCE	df	SUMS OF SQ	MEAN SQ.
Regress.	1	103.08	103.08
Error	98	110.92	1.13
TOTAL	99	214.00	

F=91.22

Interpretation 1.

Language Ability (LA) contributes a statistically significant percentage of variance in *Information* (IN).

The variable *Language Ability* comprises the syntactic component and reading comprehension and, for the purposes of this research, the score awarded to any candidate, together with that for *Information*, is an assessment most nearly representative of his or her competence in language.

Inference 1.

Reject $H_0:\beta_1=0$, and accept $H_1:\beta_1\neq0$.

2. *Syntactic Performance* (SP) will not contribute a statistically significant percentage to the variance in the *Information* (IN).

Table 4. Regression IN on SP

Variables: (a) *Information*, (b) *Syntactic Performance*

PRED.	COEFF.	S.E.	*t*-ratio	*p*
SP	0.026	0.003	8.96	<0.001

R^2 = 45.0%

Analysis of Variance

SOURCE	df	SUMS OF SQ.	MEAN SQ..
Regress.	1	96.36	96.36
Error	98	117.64	1.20
TOTAL	99	214.00	

F=80.30

Interpretation 2.

Syntactic Performance (SP) contributes a statistically significant percentage to the variance in *Information* (IN). This result indicates that an individual's ability to deal with verbal information efficiently will be influenced by his or her skill in making use of syntactic structures.

Inference 2.

Reject $H_0: \beta_2 = 0$, and accept $H_1: \beta_2 \neq 0$.

3. *Comprehension* (CO) will not contribute a statistically significant percentage to the variance in *Information* (IN).

Table 5. Regression IN on CO

Variables: (a) *Information*, (b) *Comprehension*

PRED.	COEFF.	S.E.	*t*-ratio	*p*
CO	0.064	0.013	5.01	<0.001

R^2 = 20.4%

Analysis of Variance

SOURCE	df	SUMS OF SQ.	MEAN SQ.
Regress.	1	43.65	43.65
Error	98	170.35	1.74
TOTAL	99	214.00	

F=25.12

Interpretation 3.

Comprehension (CO) contributes a statistically significant but moderate percentage to the variance in *Information* (IN). To the degree that it represents an aspect of understanding, *Comprehension* reflects ability in the semantic-pragmatic component.

Inference 3.

Reject $H_0:\beta_3=0$, and accept $H_1:\beta_3\neq0$.

4. *Mental Ability* (MA), as assessed by an appropriate test, will not contribute a statistically significant percentage to the variance in *Information* (IN).

Table 6. Regression IN on MA

Variables: (a) *Information*, (b) *Mental Ability*

PRED.	COEFF.	S.E.	*t*-ratio	*p*
MA	0.035	0.013	2.74	<0.01

R^2 = 7.1%

Analysis of Variance

SOURCE	df	SUMS OF SQ.	MEAN SQ.
Regress.	1	15.24	15.24
Error	98	198.76	2.03
TOTAL	99	214.00	

F=7.51

Interpretation 4.

Mental Ability (MA) contributes a small but statistically significant percentage to the variance in *Information* (IN). In the present study, this small percentage of the variance was deemed to have substantive significance as well, in that *Mental Ability* was expected to be an important factor, but only minimally so, in light of data from the pilot study mentioned in Chapter 1 (data from Koopman, 1985), which was concerned with the relationships among a syntactic component, intelligence and skill in dealing with information. The data from this study suggested the need for further investigation with a larger sample and more refined measures.

Inference 4.

Reject $H_0: \beta_4 = 0$, and accept $H_1: \beta_4 \neq 0$.

5. The multiplicative effect of *Syntactic Performance* and *Comprehension* (SPCO) will not contribute a statistically significant percentage to the variance in *Information* (IN).

Table 7.

Multiple Regression: Multiplicative Effect SP & CO

Variables: (a) *Information*, (b) *Syntactic Performance*, (c) *Comprehension*

PRED.	COEFF	S.E.	*t*-ratio	*p*
SPCO	0.561	1.223	6.71	<0.001

R^2 = 31.5%

Analysis of Variance

SOURCE	df	SUMS OF SQ.	MEAN SQ.
Regress.	1	67.37	67.37
Error	98	146.63	1.50
TOTAL	99	214.00	

F=45.02

Interpretation 5.

The multiplicative effect of *Syntactic Performance* and *Comprehension* (SPCO) contributes a statistically significant percentage to the variance in *Information* (IN). This finding suggests that the new variable formed is significant, and must be taken into account in any subsequent discussion.

This result emphasizes the ambivalence associated with multiplicative effects. The variable *Language Ability*, comprising the total score for *Syntactical Performance* and *Comprehension*, contributes 48.2% to the variance in *Information*, but the multiplicative, as opposed to the additive, effect contributes a significantly smaller percentage, 31.5% (See Table 1 & Table 7).

Inference 5.

Reject $H_0:\beta_5=0$, and accept $H_1:\beta_5\neq 0$.

General Comment: All Multiplicative Variables

Since the level of significance established for all hypotheses in this study is 0.05, at this level the statistical significance of the multiplicative effects must be acknowledged.

6. The multiplicative effect of *Mental Ability* and *Syntactic Performance* (MASP) will not contribute a statistically significant percentage to the variance in *Information* (IN).

Table 8.

Multiple Regression: Multiplicative Effect MA & SP

Variables: (a) *Information*, (b) *Syntactic Performance*, (c) *Mental Ability*

PRED.	COEFF.	S.E.	*t*-ratio	*p*
MASP	0.582	1.202	7.09	<0.001

R^2 = 33.9%

Analysis of Variance

SOURCE	df	SUMS OF SQ.	MEAN SQ.
Regress.	1	72.48	72.48
Error	98	141.52	1.44
TOTAL	99	214.00	

F=50.19

Interpretation 6.

The multiplicative effect of *Mental Ability* and *Syntactic Performance* (MASP) contributes a statistically significant percentage to the variance in *Information*. The new variable formed is significant, and must be taken into account in any subsequent discussion.

The influence of *Mental Ability*, as a component of a multiplicative effect, may be seen as "dampening" or reducing the contribution of the other component to the variance in *Information*.

This characteristic is further discussed in Chapter 5 (*Hypotheses 4 & 12; 6, 7, & 13*).

Inference 6.

Reject $H_0:\beta_6=0$, and accept $H_1:\beta_6\neq0$.

7. The multiplicative effect of *Mental Ability* and *Comprehension* (MACO) will not contribute a statistically significant percentage to the variance in *Information*.

Table 9.

Multiple Regression: Multiplicative Effect MA & CO Variables: (a) *Information*, (b) *Comprehension*, (c) *Mental Ability*

PRED.	COEFF.	S.E.	*t*-ratio	*p*
MACO	0.423	1.339	4.62	<0.01

R^2 = 17.9%

Analysis of Variance

SOURCE	df	SUMS OF SQ.	MEAN SQ.
Regress.	1	38.30	38.30
Error	98	175.70	1.80
TOTAL	99	214.000	

F=21.36

Interpretation 7.

The multiplicative effect of *Mental Ability* and *Comprehension* (MACO) contributes a statistically significant percentage to the variance in *Information*. The new variable formed is significant, and must be taken into account in any subsequent discussion.

The "dampening" effect of *Mental Ability* is again seen in this analysis. This characteristic is discussed further in Chapter 5.

Inference 7.

Accept $H_0: \beta_7 = 0$, and reject $H_1: \beta_7 \neq 0$.

8. The variables constituting *Syntactic Performance (Score for Verbs, Variety of Clauses*, and *Elaboration of the Subject and Predicate*: SV, VC, & EL, respectively), will not contribute individually a statistically significant percentage to the variance in *Information* (IN).

Table 10. Multiple Regression IN on SV, VC, EL Variables: (a) *Information* (IN), (b) *Score for Verbs* (SV), (c) *Variety of Clauses* (VC), (d) *Elaboration of the Subject and Predicate* (EL)

PRED.	COEFF.	S.E.	*t*-ratio	*p*
SV	-0.002	0.008	-0.29	n/s
VC	0.039	0.008	4.76	<0.001
EL	0.035	0.006	5.57	<0.001

R^2 = 48.3%

Analysis of Variance

SOURCE	df	SUMS OF SQ.	MEAN SQ.
Regress.	3	103.30	34.43
Error	96	110.70	1.15
TOTAL	99	214.00	

F=29.86

Interpretation 8.

Two of the variables constituting *Syntactic Performance* (*Variety of Clauses* and *Elaboration of the Subject and Predicate*) contribute a statistically significant percentage to the variance in *Information*. The variable *Score for Verbs* is not statistically significant in this analysis.

The discussion in Chapter 5 (*Hypothesis 8*) offers further explication of this result. However, the null hypothesis is rejected in order to conform with Hypothesis 8, which states that none of the variables is significant. In fact, VC and EL are significant at $p<0.05$.

Inference 8.

Reject $H_0:\beta_8=0$, and accept $H_1:\beta_8\neq0$.

9. The multiplicative effect of *Score for Verbs* and *Variety of Clauses* (SVVC) will not contribute a statistically significant percentage to the variance in *Information* (IN).

Table 11.

Multiple Regression: Multiplicative Effect SV & VC

Variables: (a) *Information*, (b) *Score for Verbs*, (c) *Variety of Clauses*

PRED.	COEFF.	S.E.	*t*-ratio	*p*
SVVC	0.338	1.391	3.56	<0.001

R^2 =11.4%

Analysis of Variance

SOURCE	df	SUMS OF SQ.	MEAN SQ.
Regress.	1	24.48	24.48
Error	98	189.52	1.93
TOTAL	99	214.00	

F=12.66

Interpretation 9.

The multiplicative effect of *Score for Verbs* and *Variety of Clauses* (SVVC) contributes a statistically significant percentage to the variance in *Information* (IN). The new variable formed is significant, and must be taken into account in any subsequent discussion. However, the contribution to the variance in *Information* is marginal, and the analysis was performed in order to investigate further the influence of the element *Score for Verbs* (See Hypothesis 8; Table 10).

Inference 9.

Reject $H_0:\beta_9=0$, and accept $H_1:\beta_9\neq0$.

10. The multiplicative effect of the *Score for Verbs* and *Elaboration of the Subject and Predicate* (SVEL) will not contribute a statistically significant percentage to the variance in *Information* (IN).

Table 12.

Multiple Regression: Multiplicative Effect SV & EL

Variables: (a) *Information*, (b) *Score for Verbs*, (c) *Elaboration of the Subject and Predicate*

PRED.	COEFF.	S.E.	*t*-ratio	*p*
SVEL	0.335	1.392	3.52	<0.001

R^2 = 11.2%

Analysis of Variance

SOURCE	df	SUMS OF SQ.	MEAN SQ.
Regress.	1	24.06	24.06
Error	98	189.94	1.94
TOTAL	99	214.00	

F=12.41

Interpretation 10.

The multiplicative effect of the *Score for Verbs* and *Elaboration of the Subject and Predicate* (SVEL) contributes a statistically significant percentage to the variance in *Information* (IN). The new variable formed is significant, and must be taken into account in any subsequent discussion. In general, the comments made above, in respect of Hypothesis 9, apply.

Inference 10.

Reject $H_0:\beta_{10}=0$, and accept $H_1:\beta_{10}\neq 0$.

11. The multiplicative effect of *Variety of Clauses* and *Elaboration of the Subject and Predicate* (VCEL) will not contribute a statistically significant percentage to the variance in *Information* (IN).

Table 13.

Multiple Regression: Multiplicative Effect VC & EL Variables: (a) *Information*, (b) *Score for Verbs*, (c) *Elaboration of the Subject and Predicate*

PRED.	COEFF.	S.E.	*t*-ratio	*p*
VCEL	0.622	1.157	7.86	<0.001

R^2 = 38.7%

Analysis of Variance

SOURCE	df	SUMS OF SQ.	MEAN SQ.
Regress.	1	82.76	82.76
Error	98	131.24	1.34
TOTAL	99	214.00	

F=61.79

Interpretation 11.

The multiplicative effect of *Variety of Clauses* and *Elaboration of the Subject and Predicate* (VCEL) contributes a statistically significant percentage to the variance in *Information*. The new variable formed is significant, and must be taken into account in any subsequent discussion. The contribution to the variance in *Information* is substantial. The element *Variety of Clauses*, by definition, implies the use of verbs, but the score is given for the degree of complexity of the clause, and does not imply any particular level of complexity for the verb (See Chapter 3, **Schedule of Scores** for *Syntactic Performance*). This fact is relevant to the discussions associated with Hypotheses 9 - 11.

Inference 11.

Accept $H_0: \beta_{11}=0$, and reject $H_1: \beta_{11}\neq 0$.

General Comment: All Multiplicative Variables

In keeping with the earlier comment on multiplicative effects, the statistical significance of this multiplicative variable is acknowledged.

12. *Mental Ability* (MA)), as assessed by an appropriate test, will not contribute a statistically significant percentage to the variance in the *Language Ability* (LA).

Table 14. Regression LA on MA

Variables: (a) *Language Ability* (LA), (b) *Mental Ability* (MA)

PRED.	COEFF.	S.E.	*t*-ratio	*p*
MA	1.585	0.349	4.54	<0.001

R^2 = 17.4%

Analysis of Variance

SOURCE	df	SUMS OF SQ.	MEAN SQ.
Regress.	1	32159.00	32159.00
Error	98	153089.00	1562.00
Total	99	185248.00	

F=20.59

Interpretation 12.

Mental Ability contributes a statistically significant percentage to the variance in *Language Ability*. This finding implies that non-verbal intelligence tests load on a verbal factor of some kind.

Inference 12.

Reject $H_0:\beta_{12}=0$, and accept $H_1:\beta_{12}\neq 0$.

13. The multiplicative effect of *Mental Ability* and *Language Ability* will not contribute a statistically significant percentage to the variance in *Information*.

Table 15.

Multiple Regression: Multiplicative Effect MA & LA

Variables: (a) *Information*, (b) *Language Ability*, (c) *Mental Ability*

Pred.	Coeff.	S.E.	*t*-ratio	*p*
MALA	0.117	1.467	-1.68	n/s

R^2 = 1.0%

Analysis of Variance

SOURCE	df	SUMS OF SQ.	MEAN SQ.
Regress.	1	2.94	2.94
Error	98	211.06	2.15
TOTAL	99	214.00	

F=1.365 (n/s)

Interpretation 13.

The multiplicative effect of *Mental Ability* and *Language Ability* (MALA) does not contribute a statistically significant percentage to the variance in *Information*.

Inference 13.

DO NOT REJECT $H_0: \beta_6 = 0$.

14. The demographic variables (*Age, Socio-economic Status, Education,* and *Occupation*) will not contribute a statistically significant percentage to the variance in the language variables (SV, VC, & EL & CO).

Only data for the one significant canonical variate pair are given.

Table 16. Results: Canonical Analysis

1st. Set		
Lang.Var.	Structural Coeff.	Std.Coeff.
SV	0.64	0.58
VC	0.29	-0.20
EL	0.55	0.02
CO	0.85	0.79
2nd. Set		
Demog. Var.		
AG	0.52	0.53
SE	0.35	0.21
ED	0.79	0.73
OC	0.62	0.12

$R_{c(1)} = 0.49$; $\chi^2 = 34.73$; $p<0.01$

Interpretation 14.

Only the first pair of canonical variates is significant, and only the data pertaining to this pair are quoted. The language variable with the highest magnitude is *Comprehension* (CO), and the demographic variable with the highest magnitude is *Education* (ED). Among the language variables, however, *Score for Verbs* (SV) and *Elaboration of the Subject and Predicate* (EL) are important, and *Occupation* (OC) and *Age* (AG) are significantly represented among the demographic variables. Consequently, the language variables may reasonably be seen as representing *Language Ability*, for its structure is substantially that of the variable (LA) so named in the regression analyses. Similarly, the demographic variables may be designated *Vocational Component* (VO). In any further discussion, these terms may be used. The pattern of the standardized coefficients supports this interpretation.

Inference 14

$H_{0(14)}: R_C^2 = 0$, and accept $H_{1(14)}: R_C^2 \neq 0$.

[Reference: Tabachnick & Fidell (1983)].

Demographic Variables: Distributions

Age: The distribution among the subjects was positively skewed (g_1 = 1.50) and leptokurtic (g_2 = 1.15). An index of 0 in both instances signals a normal distribution. The details are given below:

[Fr. = Frequency]

Table 17. Distribution by Age

AG.	Cat.1	Cat.2	Cat.3	Cat.4	TOTAL
Range	20-9	30-9	40-9	50-9	
Fr.	68	18	11	3	100

Socio-economic Status, based on the occupation of the supporting parent during the subject's formative years, was established under eight categories:

15. Unskilled worker
16. Service worker
17. Clerical worker
18. Secretary (supervisory)
19. Skilled artisan
20. Technologist
21. Proprietor, Manager, Administrator
22. Professional

Professional personnel are men and women who are licensed to practise in a specified field after specialized education, training, and generally some form of internship.

A technologist holds a qualification from an institution of advanced education or from a professional body. This qualification is of a standard immediately below that of the professional in the same category of employment.

Proprietors, Managers, and Administrators are those in direct control of subordinates, or they may be owners of small and medium-sized businesses.

The distribution among the subjects was negatively skewed ($g_1 = -0.19$) and platykurtic ($g_2 = -1.00$).
The details are given below:

Table 18. Distribution by Socio-economic Status

SE.	1	2	3	4	5	6	7	8	TOT.
Fr.	0	11	12	5	33	7	20	12	100

The category *Education* was assessed by adding to the number of years of public education credit for adult academic and techical courses. Three courses of twelve weeks' duration were deemed the equivalent of one academic year. The scores awarded were the equivalent of the number of years assessed in this way.

The distribution among subjects was positively, but only slightly, skewed ($g_1 = 0.28$) and mildly leptokurtic ($g_2 = 0.86$). The details are given below.

Table 19. Distribution by Education

ED.	8&9	10&11	12	13	14	15	16	17&18	TOTAL
Fr.	2	14	24	31	16	4	7	2	100

Occupation, as a variable, is classified similarly to *Socio-economic Status*.

The distribution was positively skewed (g_1 = 1.02) and leptokurtic (g_2 = 0.86). The data thus indicate that the majority of subjects were currently employed in unskilled or semi-skilled jobs. The details are given below:

Table 20. Distribution by Occupation

OC.	1	2	3	4	5	6	7	8	TOTAL
Fr.	12	38	20	8	14	2	4	2	100

CROSS-VALIDATION

The variables of the regression equation in the cross-validation procedure were *Syntactic Performance* (SP), *Comprehension* (CO), *Mental Ability* (MA), and *Information* (IN). The results were:

1. Screening Sample: Mean Square Residual = 1.3585
2. Calibration Sample: Average Squared Residual = 1.0622

The difference of 0.2959 between these residuals indicates a fairly stable equation in the context of explaining the relationships among the several variables.

These residuals are based on the "best subset" of variables for the regression equation. This subset comprises *Syntactic Performance* (SP) and *Comprehension* (CO) as predictors, and *Information* (IN) as the criterion. The contribution of *Mental Ability* (MA) was not statistically significant in this analysis.

TESTS OF SIGNIFICANCE: MAIN VARIABLES

Syntax: Scoring. Two methods of scoring: Difference between means (for correlated samples): $t=0.21$ ($p<0.05$).
Correlation (two methods of scoring)=0.85 ($p<0.05$).
These tests were applied to the method of assessing *Syntactical Performance* explained in Chapter 3, and to scores generated by calculating the number of words per T-unit (Hunt, 1965).

Information: Scoring. Two methods of scoring: Difference between means (for correlated samples) was not significant: $t=0.56$ ($p<0.05$).
Correlation (two methods of scoring)=0.77 ($p<0.05$).
These tests were applied to the method of assessing the *Information* by this writer's modification of the system by Schroder et al., (1967) and to scores generated by the Princeton Manual Guidelines.

CHAPTER 5. DISCUSSION

Deliberando discitur sapientia

THE VARIABLES RE-EXAMINED

Main Variables

The focus of this research was to explain, within the constraints imposed by the size and constitution of the sample, the selected instrumentation, and time, the relationship of language and mental ability in the treatment of verbal information by adults.

Language was investigated from two perspectives. One was concerned with syntactic structures and with comprehension, which is an aspect of receptive language; the other was directed to the content perceived in the language used as a form of self-expression when faced with one of a set of controversial issues.

Joint Effects and Related Terminology

The interpretation of a mutual effect between independent variables is complicated and a source of dispute in non-experimental research. (Allison, 1977; Cohen, 1978; Darlington, 1968; Duncan, 1975; Pedhazur, 1982). The variables are usually and inevitably beyond the complete control of the investigator, and they are rarely orthogonal.

An immediate problem, then, is to decide whether or not one is justified in equating a joint or multiplicative effect or product-term with an interaction, which is properly the relationship between two or more uncorrelated or orthogonal variables (Pedhazur, 1982).

Interaction implies that a new variable has been created which retains nothing of the characteristics of the elements that have interacted. For instance, if one may employ an analogy: in the resultant oxygen, there is no evidence of the manganese dioxide and potassium chlorate which were used to "make" it. Pedazur (1982) stated: ". . . a distinction between interactions and multiplicative relations was suggested as a safeguard against the routine, frequently mindless, use of product terms in non-experimental research [p.429]."

There is, too, a related question concerning the identification of contributions by the predicting variables to the variance in the criterion or dependent variable. Darlington (1968), Duncan (1975), and Pedhazur (1982) doubted the validity of stepwise regression, based on the theory of variance partitioning, as a means of determining *relative* importance, especially when the predictors are intercorrelated. Darlington (1968) went so far as to assert that "[It] would be better to simply concede that the notion of 'independent contribution to variance' has no meaning

when predictor variables are intercorrelated [p.169]," and Duncan (1975) appeared to close the argument with:

> The simplest recommendation—one which saves time and worry—is to eschew altogether the task of dividing up R^2 into unique causal components. In a strict sense, it just cannot be done (p.65).

This researcher decided to avoid the term "interaction," and to use instead the less controversial term "multiplicative effect," which leaves the technical question of shared variance unresolved, but continues to acknowledge that there may be present a new variable whenever two or more predictors are employed. Pedhazur (1982) has stated quite categorically that there is no substitute for sound thinking based on acceptable theory, and that such an approach will act as "the best safeguards against drawing unwarranted, illogical, or nonsensical conclusions [p.175]." He added that while prediction was straightforward and could be achieved without a thorough knowledge of theory, the explaining of phenomena was inconceivable without extensive theoretical underpinning.

DISCUSSION OF THE ANALYSES

The first set of analyses concerned the (a) main language variables (Tables 3 - 5), (b) relevant multiplicative effects (Table 7), (c) elements constituting *Syntactic Performance* (Table 10), and (d) all multiplicative effects pertaining to them (Tables 11 - 13).

The second set of analyses was directed to the influence of (a) *Mental Ability* as a sole predictor (Tables 6 & 14), and (b) all relevant multiplicative effects (Tables 8, 9, & 15).

The third analysis examined the influence of selected demographic variables on language (Tables 16 - 20).

Hypotheses 1 - 3 & 5

Hypotheses 1 - 3

The relationship between the main language variables *Syntactic Performance* and *Comprehension*, treated as the composite *Language Ability*, and the variable *Information* was substantial. The percentage of shared variance was 48.2% (Table 3) *Syntactic Performance* alone contributed 45.0% (Table 4), and *Comprehension* alone accounted for 20.4% (Table 5). These data furnish statistical confirmation of the perceived relationship between the two components of language, as they are defined and assessed for this study.

In the discussion of Hypothesis 5 below, the relationship is examined further.

Hypothesis 5

There was a significant relationship between the multiplicative effect involving *Syntactic Performance* and *Comprehension* and the variable *Information* (Table 7). This effect, as the sole predictor, accounted for 31.5% of the variance in *Information*, and may be seen as a new variable, neither wholly structure, nor exclusively content. Conceptually, this new variable makes sense as "language-in-use," for unlike *Language Ability*, which statistically is recorded as the additive score (*Syntactic Performance* + *Comprehension*), it is represented by a score that may reflect more directly than does *Language Ability*, the mutual interplay of the constituent variables.

In light of the statements by Darlington (1968), concerning the independent contributions to variance by predictors that appear to be inter-correlated, one should perhaps not attempt to reach a definitive conclusion which will inevitably rest on a procedure—the partitioning of variance in non-experimental research—that nowadays is the subject of controversy (Darlington, 1968; Duncan, 1975; Pedhazur, 1982).

Hypotheses 8 - 11

The statistics (Tables 10 - 13) applicable to the individual constituents of *Syntactic Performance (Score for Verbs, Variety of Clauses*, and *Elaboration of the Subject and Predicate*) and the percentage that each contributes to the variance in *Information* emphasize aspects of the situation found in the data concerning Hypotheses 1 - 3, and Hypothesis 5 (Tables 3 - 5 & 7).

Hypothesis 8

Hypothesis 8 is based on the speculative question of the relative importance of each of the elements set forth as valid representations of syntax. Entered as three separate scores, these elements accounted for 48.3% of the variance in *Information* (Table 10), which is almost identical with the proportion accounted for by *Language Ability* (Table 3: 48.2%). When the scores for these elements were entered as a single additive score for *Syntactic Performance*, the percentage of variance attributable to the variable was 45% (Table 4). These three percentages represent correlation coefficients of 0.67 - 0.69 between the language variables in various combinations and the variable *Information*.

Hypotheses 9 - 11

The multiplicative effects generated by all possible pairs of the elements in *Syntactic Performance* (Tables 11 - 13) emphasize again the difficulty of trying to apportion variance when the predicting variables are inter-correlated, and perhaps, as Duncan (1975) asserted, to attempt to do so is a futile quest. However, one statistic concerning the syntactic elements calls for an additional explanation.

In Table 10, *Score for Verbs* is shown as not significant in the regression equation. In addition, the multiplicative effects that involved *Score for Verbs* (Tables 11 & 12) each contributed only a modest percentage to the variance in *Information*, as compared with the corresponding effect concerning *Variety of Clauses* and *Elaboration of the Subject and Predicate* (Table 13: 38.7%).

In order to clarify the significance of the verb, as assessed by the procedures adopted in the present study, this researcher, in an *a posteriori* analysis, entered the variable *Score for Verbs* as the only predictor of variance in *Information*. The percentage accounted for was 12.1%, and it was significant ($p<0.05$).

The real issue in respect of the verb, as one element to be taken into account in any assessment of syntactic skill, is not the validity or the necessity of including it. In the literature, there is no case for dropping it, and

every reason for its retention. The more rewarding course is to examine the behaviour, so to speak, of the variable *Score for Verbs* in the data that were analyzed. Additional issues concerning the *Score for Verbs* are examined in Chapter 6 (**Implications for Further Research**).

Hypotheses 4 & 12; 6, 7 & 13

Hypotheses 4 & 12

The variable *Mental Ability*, as a sole predictor, contributed a statisticallly significant percentage to the variance in *Information* (Table 6: 7.1%), but this amount indicates a minimal relationship, when compared with the much stronger link between *Mental Ability* and *Language Ability* (Table 14: 17.4%).

The instrument used to measure *Mental Ability* is an important factor in explaining the small amount of variance that was shared with *Information*.

If a non-verbal test can account for 17.4% of the variance in a language variable, *viz. Language Ability*, implying a correlation of 0.42 between the variables, one may reasonably expect to find a much higher correlation between verbal intelligence and language. One is then obliged to ask what exactly is being measured in a verbal intelligence test: a purely intellective factor which,

presumably, is common to all cognitive/academic endeavours—the factor assumed to be measured by the *Test of Nonverbal Intelligence* (1982), Raven's *Matrices* (1977), and comparable instruments which, by definition, do not contain any language sub-tests, and are acknowledged to be valid and reliable tests of general intelligence (Brown, Sherbenou, & Dollar, 1982; Leiter, 1948; Raven, 1977; Tate, 1952)—or competence in the use of language.

Frank (1983), in discussing abbreviated versions of Wechsler's tests, showed how two or three of the verbal sub-tests correlated very highly with the *Full Scale* intelligence quotient, and were sufficiently accurate to be used as a screening device if not for individual prediction of intelligence.

The reader's attention is also directed to Chapter 4 (**CROSS-VALIDATION**), where the "best subset" of variables for the regression equation comprises *Syntactic Performance* and *Comprehension*, the contribution of *Mental Ability* to the variance in *Information* not being statistically significant.

Hypotheses 6, 7, & 13

The multiplicative effects in which *Mental Ability* is one of the variables (Tables 8, 9 & 15) were statistically significant as predictors. In the first of these two instances (Tables 8 & 9), the criterion was the variable

Information, and the corresponding percentages of explained variance were 33.9%, for the effect concerning *Mental Ability* and *Syntactic Performance* (Table 8), and 17.9% for the effect deriving from *Mental Ability* and *Comprehension* (Table 9). The third multiplicative effect concerned *Mental Ability* and *Language Ability*, and was not significant (Table 15).

Taking note of the objections raised by Allison (1977), Cohen (1978), and Pedhazur (1982) still leaves unresolved the question of why, by itself, *Language Ability* contributed a major proportion of the variance in the variable *Information* (Table 3), but jointly with *Mental Ability* had no significant effect (Table 15).

There are two possible explanations. One is recognizing that a simple linear regression yields predicted scores with either a small or large error factor; but a multiple regression, particularly one with significant multiplicative effects will not necessarily generate a simple equation. A particularly significant influence is the order in which the variables are entered for analysis. The second explanation concerns the ambivalent and "dampening" effect of the variable *Mental Ability*, of which there are two other instances in these present analyses (Tables 8 & 9).

For the present, one can only suggest the need for further investigation of the relationships which are

emerging in connection with language and intelligence.

Hypothesis 14

Hypothesis 14 was directed toward examining the effects of selected demographic variables on performance in language.

The procedure adopted for this purpose was canonical correlation analysis, with *Score for Verbs*, *Variety of Clauses*, *Elaboration of the Subject and Predicate*, and *Comprehension* as the First Set (now identified as *Language Ability*), and *Age*, *Socio-economic Status*, *Education* and *Occupation* as the Second Set (now designated *Vocational Component*).

A summary of data from the canonical analysis is presented in Table 16. A further selection of tables from the analysis is contained in Appendix A.

The analysis extracted one pair of canonical variates from the two sets of variables (language variables and demographic variables). A canonical variate is a linear combination of the variables arranged in order of magnitude, and the canonical variate of one set is examined in relation to the other. Table 16 shows structural coefficients or canonical variable loadings, which may be interpreted, in each instance, as the correlation of a canonical variable with the corresponding original variable. Also shown are

standardized coefficients or standardized weights (Mean=0; SD=1).

In *Language Ability, Comprehension* is shown to be the dominant variable (Structural Coefficient = 0.85; Standardized Coefficient = 0.79); and in the *Vocational Component, Education* is dominant. (Structural Coefficient 0.79; Standardized Coefficient 0.73). The Canonical Correlation (R_{ci}) of 0.49, given at the end of Table 16, when squared, gives the percentage (24.5%) of shared variance between the *Language Ability* and the *Vocational Component*. Thus, the demographic variables exercised a moderate influence on the language variables as a group or set.

CHAPTER 6. SUMMARY AND GENERAL DISCUSSION

Cave quid dicis, quando et cui

SUMMARY

Background

This investigation was undertaken after statistical analysis of data collected for Koopman's studies for the Government of Canada (Koopman, 1983, 1985, 1988) suggested further examination of the relative importance of language ability and mental ability as factors in influencing skill in dealing with verbal information. The success of this examination depended on the adoption or development of more refined instrumentation and the testing of a sample drawn from a general population. Koopman's studies, by their terms of reference, were concerned with special classes of subjects.

The Present Study

This researcher has attempted to show, within the constraints imposed by the size and constitution of the sample, the selected instrumentation, and the time available for testing, that the ability to use language effectively is of major importance in receiving, expressing, and acting on verbal information: that although intelligence is a factor

which cannot be discounted, it does not, in this context, exercise the influence that it has often been assumed to have.

Plan of Action

This researcher tested a group of employable men and women, aged 20-60 years, from the area of the Greater Vancouver Regional District. Each subject was asked to provide a written opinion on a topic that he or she chose from a selection of six, complete a test in reading comprehension, and a non-verbal intelligence test, and supply specific demographic information.

Analysis of Data

Simple regression and multiple regression analyses were applied to the test data. The relationships among the language variables and demographic variables were assessed by means of canonical correlation analysis.

ACHIEVEMENT OF OBJECTIVES

The first objective of this research was to determine the relative significance of the effects of specific language variables and mental ability on the individual's skill in developing verbal information as the basis for the solution of problems of social concern.

The first four research questions and the corresponding hypotheses concerned this first objective. The variable *Language Ability* was clearly of prime importance in dealing with verbal information, and of the two components in this variable, syntax (*Syntactic Performance*) was the more significant. However, one must recognize, from the evidence presented in Chapter 4, that mental ability, as defined in the corresponding variable, played a statistically significant but minor role in this process. This finding may be seen as adding a performance dimension to Chomsky's assertion (Chomsky, 1972) that the individual's ability to develop syntactical competence "is essentially independent of intelligence [p.79]."

The evidence also suggested that the introduction of an intelligence test in a procedure designed to assess the role of language in the development of verbal information had a "dampening" or "suppressing" effect on the influence of the language variables.

Additionally, the results referring to the multiplicative effects of the variable *Mental Ability* and specific language variables raised the question of the usefulness of a test of intelligence in an assessment of the ability to deal effectively with information. Schroder et al. (1967) found that the correlations between subjects' intelligence and their ability to make use of various levels

of conceptual structure to lie in the range 0.12 - 0.45. They pointed out that the range of intelligence quotients for the subjects was 90 - 150; and that if those subjects of inferior ability were omitted, the correlation coefficients were lower. Schroder et al. (1967) concluded:

> To the extent that intelligence test items call for the utilization of alternate and complex rules for correct solutions (in contrast to simple retrieval or conditional rules), intelligence or conceptual structure measures would be related. Indeed, if intelligence were defined in this way (in terms of the flexibility of integrative conceptual processes) and if we could assume that conceptual level was the same across very different stimulus areas (such as intelligence-type questions and social problems), which it is not, then the two would be identical (p.198).

The above summary suggests that the first objective was achieved: the ability to use language with effect is the major prerequisite for the successful processing of verbal information.

The second objective was to examine the feasibility of assessing adult syntax in terms of the quality of the verb, the variety of clauses, and the enrichment of the sentence

by phrasal structures, inversion, and emphasis. Such an approach to the measurement of syntax was dictated by the nature of the specific questions posed for this research. The literature (Crystal et al., 1976; Lee, 1966, 1974; Lee and Canter, 1971, and Tyack & Gottsleben, 1977) furnished support for the selection of the elements, and the validity of the method in its entirety is confirmed by reference to an external criterion (*Minimal Terminable Unit*: Hunt, 1965), and the subsequent correlation generated by comparing the results of the two systems of scoring.

Inter-rater reliability in interpreting the system of scoring for each element was supported by the correlation obtained from a comparison of the scores awarded by two different markers, as reported in Chapter 3 (**Reliability and Validity:** *Syntactic Performance*).

These data suggest that the second objective was achieved.

The third objective concerned the effect on performance in language of specific demographic variables (*Age*, *Socio-economic Status*, *Education*, and *Occupation*).

Demographic data were classified and scored according to the schedules set out in Chapter 3. The source of these data was the form **PERSONAL INFORMATION** (Appendix C) which was completed by each subject before the beginning of the testing session.

The minor influence of the demographic variables on performance in language was attested to by the results of the canonical analysis. This finding does not entirely agree with the general tenor of the views put forward by Bernstein (1962, 1972) that there is a significant correlation between social class and language codes. The discrepancy may be attributed to the greater range of ability within Bernstein's various categories.

GENERAL DISCUSSION

Practical Applications

Educational Assessment and Diagnosis

The genesis of this research is to be found in the objectives that prompted Koopman's studies (1983, 1985, & 1988). The first two of these studies concerned the cognitive deficiencies of certain inmates in federal penitentiaries; the third was directed to the identification of adults who had been diagnosed as, or who believed themselves to be, learning-disabled. In each of these studies, a deficiency in one or more of the competencies associated with language appeared to be particularly significant in the overall difficulties they were experiencing in their work and in personal relationships.

The identification of these difficulties and a differential diagnosis in individual cases could not be satisfactorily achieved without first establishing, especially in language, which competencies and which levels of performance represented the norms to be found in the general population, and then developing a valid and reliable instrument for measuring achievement among those in the adult population who appeared to lack the required skills.

A careful study of the characteristics associated with the deviant case sometimes furnishes a clue to the methods of diagnosis and assessment that may usefully be applied generally. An example of this type of approach may be seen in the history of the development of Wechsler's tests.

The two tasks described above were undertaken by this researcher when he recognized that there was no systematic method of analyzing adult language, whether spoken or written, in such detail as would furnish an assessment of skill in terms of the more important elements of syntax, and relate this performance to the employment of language as exemplified by the processing of verbal information.

This study, then, looked beyond the exceptional case and attempted to determine the constancies in, or the expected characteristics of, adult language in the context of how successfully this language is used in daily life.

The written sample of an individual's language,

prompted by the introduction of some topic of general interest, is a proven method of establishing how well an adult can use language, both as a sequence of structures and as the expression of thought. The assessment procedures used in this research for assessing the quality of language in use embodied these two aspects. The approach to the assessment of syntax, while based on sound theory and validated as described in Chapter 3, was an original approach which recognized verb-complexity, clausal variety, and the embellishment of the subject and predicate as critical elements in the syntactic component. Standardized tests were used to measure semantic skill and mental ability.

In connection with the measurement of adult language, a reliable and well-validated approach is the *Minimal Terminable Unit*, developed by Hunt (1965). However, the application of the *Minimal Terminable Unit* furnishes a measure of syntactical skill overall, but does not treat separately the individual elements that define syntax in this research.

Language and the Curriculum

The approach to the assessment of adult language adopted in this study may realistically be applied at the post-secondary level of education. The original products

generated by assignments in English composition classes can provide sufficient material for language analysis, and combine the measurement of the structures of language with that of the content which the medium is employed to convey. The approach, then, examines receptive language (by means of a reading comprehension test) and, in one piece of written English, expressive language and the quality of thought as exemplified by the individual's solution to the problems presented by the questions posed as part of the assessment. Instructors in adult basic education and in job-training classes in the colleges visited by this researcher during the period of data collection recognized these possibilities, and were planning to compare assessments made by their own procedures with those obtained by the methods outlined here.

The measures developed for this study may very well provide a means of analyzing other forms of adult language, especially to determine if there may be hierarchies of syntax and verbal forms.

In the context of occupations, for instance, one may consider English as the language of a specific technology or trade, exhibiting, in addition to a peculiar vocabulary, an efficient syntax, developed by usage within the occupational group. There is also language as the medium for employees of a government—a language which undoubtedly has its own

justification, but one not always obvious to the ordinary citizen.

The procedures outlined for assessing the quality of adult language may now safely be used in future research directed particularly to the syntactic component and its bearing on a particular level of competence in language performance as the means of developing and acting on verbal information.

Assessment of language competence is essentially a first step, and may need to be followed by remedial measures. From the scores already obtained, a description of the relative strengths and weaknesses in performance can be constructed to form the basis of a diagnosis and appropriate teaching methods for adults whose language skills are impaired.

Language and Special Circumstances

In addition to furnishing the instructor with a valid method of analyzing adult syntax in essential detail, the approach now offered may be used to help in clarifying a particularly controversial issue in developmental psychology (and essentially in language), which Dale (1976) described as fundamental: whether it is cognitive advance that explains improvement in language, or an improvement in language performance that ensures the achievement of a

higher level of thinking and understanding. This issue is exemplified in circumstances where the need to express oneself and to understand what others are saying or have written is particularly urgent.

There appears to be little doubt that if the concepts represented by the content are to be accurately made known, the syntactic structures available to the speaker or writer must be equal to the task, and conversely, if the language is deficient, the capacity to entertain concepts of significant difficulty is impaired. In support of this contention, one may consider the conduct of a disadvantaged youth when questioned as a suspected offender by the police and prosecutor. Frequently, this suspect is unable to appreciate the implications of the questions that he or she is being asked, and is equally handicapped when a reply is expected. One may ask to what extent the quality of language governs what the young person is able to express and understand.

The need to establish the relationship between thinking and language is again of importance in prison education. It would seem to be reasonable to claim that rehabilitation and re-education in preparation for eventual release from jail cannot be considered as likely outcomes, if the patterns of thought of the inmates concerned have not been analyzed by these inmates and the instructors together, and the

weaknesses and misconceptions corrected.

Dialectal and other Variations

This method of assessing syntactic skill is also useful as the means of identifying the sources of misunderstanding that can arise when the language is common, but the idiom is peculiar to a region, occupation, or to the simplified forms which may be adopted by those for whom English is a second language.

The method can also be extended to the study of the variants of the language found in countries which have gained their independence and are English-speaking, or have retained English as an official language.

In both instances, the method can be the means of initiating an appreciation of equivalent content, that is of expressions with similar meanings, but different constructions. The essence of this type of comparative study is the choice not only of the main variables, but also of the elements which define the particular language components. Detail of degree represented by verb-complexity, clausal variety, and modification of the subject and predicate is sufficient to lay bare the differences and the similarities of the various linguistic forms found among the variants of English. Among them, and perhaps the most common, is the idiom.

Personnel Selection

Today, a particular urgency attaches to all forms of assessment of personnel, and particularly to those calling for a realistic assessment of mental attributes in relation to understanding and making effective use of verbal information in an international milieu, where the common language is English. Selection processes for the more responsible positions in the higher professions and in business sometimes depend on procedures that are "remote" (in the sense of their being conducted by agents on behalf of institutions and firms located overseas), and they often serve as the first screening of applicants, before there is too heavy a financial commitment.

In any such screening, whether for jobs overseas or in Canada, the ability to express oneself effectively and to understand what is spoken or written by others is paramount in selection, and critical in building self-esteem and in the achievement of subsequent occupational and professional goals. In this situation, one may wish to question the usefulness of an intelligence test in a situation where a comprehensive assessment of language performance as the common means of communication can be directly related to an academic course or gainful employment.

Thus, apart from the desire to assess an applicant's present achievements, there may be an equally urgent need to

undertake formative evaluation procedures. As far as language is a critical component of such evaluation, it may usefully be measured by following the methods contained in Chapter 3. This approach does not require a test-retest procedure, for on the occasion of each evaluation, the language sample is unique and is scored without reference to model answers.

Limitations

A General Limitation

The limitation which is a characteristic of possibly all research in the social sciences is the difficulty of controlling the variables, selected and extraneous, and the conditions impinging on the performance of the subjects. The researcher in education rarely achieves the degree of manipulation and control of the variables typical of investigations carried out in the laboratory (Campbell and Stanley, 1966). Pedhazur (1982) asserted that in non-experimental research, "the researcher can neither manipulate nor randomize [p.578]." Kahneman (1965) warned also that a recurring problem was the presence of confounding and spurious correlations. To these criticisms may be added the assertions of Lord (1960) and Meehl (1970) that pre-existing differences among subjects can never be

adequately controlled, and one must accept that "the tiger in the laboratory is not the same beast as the tiger in the jungle."

In connection with the views expressed above, this researcher recognizes that speculation must play a part in reaching any conclusions in a study of this present kind. One may hope, however, that it is speculation supported in large part by close observation of phenomena, the careful analysis of statistical data, and a very conservative interpretation of any results. Continued study of the questions raised here, in new locations and with different subjects, will alone confirm the significance of what is reported in these pages.

Sample Selection and Geographical Location

The available sample of subjects met the criteria which the investigator had established. It cannot be assumed that individuals in rural areas and in other urban centres in Canada will respond to the tests and particularly to the topics for the language sample in ways that are identical with those presented here. Such groups may exhibit views different from those of the subjects tested in Vancouver, and their scores may present different profiles as among samples and tests. Consequently, the conclusions from this study must once again be accepted as only an indication—but

one based on statistical data—of what may be expected in other areas of Canada.

Implications for Further Research

Score for Verbs

A reference to Appendix A (**Distribution Data**) indicates that the distribution of scores for the variable *Score for Verbs* deviates from the normal, and this deviation is again reflected in the distribution of the variable *Syntactic Performance*, of which the *Score for Verbs* is a constituent. Here, the distribution is significantly leptokurtic, but is not seriously skewed.

This method of scoring the verb may need further refinement. In the present scoring, certain verbs and tenses do not receive credit. They are deemed to be non-discriminating as the means of differentiating levels of performance. There is, in other words, possibly a "basement effect." It is possible that at the more complex levels of verb-structure, there may be a "ceiling effect," when the verbal forms fail to differentiate levels of performance in relatively informal composition, because they are not the currency of such language. This suggestion obviously needs to be investigated more thoroughly. On the other hand, the instability of the variable in this research may not be the

consequence of any real deficiencies in the allocation of scores. It could be related to the nature of the sample, or to the nature of the discourse demanded by the experimental procedure. As has been stated in Chapter 5, dispensing with any measurement of verb complexity in assessing syntax is not supported by the literature.

To clarify further the significance of the verb in this context, the following research question may be posed:

(a) What factors in the scoring of the variable *Score for Verbs* affect the distribution of the scores for this variable?

Language and Mental Ability

In this study, the test for mental ability was non-verbal. Further investigations, employing (a) another non-verbal test (*e.g.* Raven's *Progressive Matrices*) and (b) a verbal test (*e.g. Wechsler Adult Intelligence Scale-Revised*) with the same language variables and criterion, could be expected to produce useful data for a comparative study. If there were discrepancies among the scores, large enough to cast doubt on the acceptability of the results, there would be a call to challenge the appropriateness of the instruments for this type of study. In this connection Claunch (1964) found that there was no significant correlation between scores for intelligence, as

measured by the *Scholastic Aptitude Test*, and essays assessed for capacities that are essential for developing information. There was a significant relationship between the *Scholastic Aptitude Test* and the more objective, factual tasks.

No attempt was made in this present investigation to establish a lower limit for mental ability. Conventional wisdom suggests that there must be a level at which mental ability assumes a definite and disabling role for the individual who must deal with information, and one may predict that the level for conveying information orally will not be the same as that which ensures similar success with written material.

Two research questions may be examined in the context of language and mental ability:

(b) What are the limits of variability that may be expected in performance on (i) a verbal intelligence test and a non-verbal intelligence test, and (ii) two different non-verbal intelligence tests when each performance is compared with the corresponding performance in developing information?

(c) What level of intelligence, as measured by an appropriate non-verbal test, signals a disabling condition for those charged with understanding and acting on verbal information?

Language and Pragmatics and Information

Obtaining information implies learning, and there is the need to study how individuals use new information in the solution of old and of novel problems. This is one very specific form of information processing. The correlate of this study is to determine how and to what degree new information influences attitudes and values: in other words, are solutions to problems or evaluations of any human condition a function of a significant amount of the information individuals process concurrent with the emergence of the problem or evaluation, or do individuals tend to fall back on old, and perhaps more comfortable attitudes and values? In either situation, quality of language is a critical factor. For some, a sound argument, presented in clear, unambiguous language is persuasive. For others, rhetoric is sufficient to sway opinions.

In the exchange of information, the ability to see the points of view of others represents a significant step in interpersonal relationships. It is not likely to be found in organizations in which thinking is based on a single rule, *e.g.* where the organization is invested with one approach to a number of issues, or only one perspective is entertained. If there are multiple perspectives, interrelated in some way, thinking is much more complex, and a definitive judgment on any issue is difficult to arrive at, and may be

undesirable (Schroder, 1971).

To see another's point of view demands more than goodwill and satisfactory interpersonal relationships. There must be an effective means of communication, the success of which is governed by the appreciation which each party has of the other's actions, and here pragmatics is the key—"the study of the use of language in context, by real speakers and hearers in real situations [Bates, 1974: p.258]."

The area of pragmatics is relatively unexplored. Consequently, research studies here could specifically be directed to investigating the importance of the semantic-pragmatic component in relation to syntax and, generally, in the processing of verbal information. As Suedfeld (1971) has remarked:

> Given the ubiquity of communicative and problem-solving acts in daily life, any set of theories which has promise of accurate categorization and prediction of such behaviors is bound to play a large role in the personology of the future (p.12).

The appropriate research questions may take the form:

(d) To what degree are attitudes governed by the characteristics of language?

(e) What are the syntactic and other structural forms that

characterize the esoteric languages of some professions and occupations?

CONCLUSION

Thirty years ago, a rapidly growing knowledge about the universe, travel in space, and medical and surgical achievements were popularly seen as the areas of revolution; but there were some men and women who could anticipate that the greatest revolution in this century would be in communication. Few could doubt that these recent years have borne witness to the fundamental changes which they foretold.

This chapter, while discussing issues raised in the present research, has been an excursus to the borders of the vast, unexplored territory comprising language, intelligence, and how individuals express and make use of information. The study itself was prompted by the observation of trends in scores analyzed several years ago. When data concerning language and mental ability were collected in 1988, and analyzed, the trends and conclusions were further confirmed, and have been presented in the foregoing pages.

Whatever the field of investigation, whether it is mathematical, scientific, medical, or any other, the imperative is communication, and through communication,

sharing. Man has advanced through the ages because he wandered physically and mentally, and found others of his kind with something to share. In the words of Whitehead (1963):

> When man ceases to wander, he will cease to ascend in the scale of being. Physical wandering is still important, but greater still is the power of man's spiritual adventures (p.8).

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APPENDIX A

LANGUAGE AND DEMOGRAPHIC VARIABLES: SUMMARY OF DATA

LA comprises *Syntactic Performance* and *Comprehension*. SP comprises *Score for Verbs*, *Variety of Clauses*, and *Elaboration of the Subject and Predicate*].

LA = *Language Ability*

SV = *Score for Verbs*

VC = *Variety of Clauses*

EL = *Elaboration of the Subject and Predicate*

SP = *Syntactic Performance*

CO = *Comprehension*

MA = *Mental Ability*

IN = *Processing of Information*

AG = *Age*

SE = *Socio-economic Status*

ED = *Education*

OC = *Occupation*

VO = *Vocational Component*

Distribution Data

Varbl.	Mean	S.Dev.	Skew.	Kurt.
SP	87.60	37.82	01.52	05.84
SV	16.28	15.44	03.21	15.40
VC	37.30	15.21	01.04	01.38
EL	34.88	19.12	00.54	00.20
CO	18.90	10.44	00.11	-00.90
AG	01.51	00.85	01.50	01.15
SE	05.21	01.86	-00.19	-01.00
ED	12.87	01.74	00.28	00.86
OC	03.07	01.68	01.02	00.43

Correlations

Var	SV	VC	EL	CO	AG	SE	ED	OC
SV	1.00							
VC	0.47	1.00						
EL	0.41	0.35	1.00					
CO	0.18	0.26	0.46	1.00				
AG	0.22	0.13	0.23	0.18	1.00			
SE	0.20	0.14	0.06	0.04	-0.02	1.00		
ED	0.18	0.56	0.15	0.38	-0.05	0.17	1.00	
OC	0.18	0.04	0.26	0.26	0.27	0.20	0.42	1.00

Multicollinearity, Eigenvalues, & Canonical Correlations

R^2 for each 2nd. Set Variable with all other 2nd. Set Variables are:

Variables	R-squared
AG	0.11
SE	0.05
ED	0.21
OC	0.28

R^2 for each 1st. Set Variable with all other 1st. Set Variables are:

Variables	R-squared
SV	0.29
VC	9.26
EL	0.33
CO	0.23

Eigenvalues and Canonical Correlations are:

Eignv	R_C	χ^2	df	Prob.
		34.73	16	0.004
0.2449	0.495	8.18	9	0.516
0.4381	0.209	3.95	4	0.413
0.0405	0.201	0.04	1	0.847
0.0004	0.020			

Standardized Coefficients

Standardized Coefficients for the Canonical Variables of the First Set and the Second Set.

1st. Set (LA)		2nd. Set (VO)	
SV	0.580	AG	0.525
VC	-0.198	SE	0.205
EL	0.019	ED	0.733
CO	0.793	OC	0.123

Canonical Variable Loadings

Canonical Variable Loadings for the First Set and the Second Set (correlations of the canonical variables with the original variables)

1st. Set (LA)		2nd. Set (VO)	
SV	0.637	AG	0.518
VC	0.286	SE	0.345
EL	0.549	ED	0.793
CO	0.853	OC	0.615

Average Squared Correlations

The average squared loading (ASL) multiplied by the squared canonical correlation (SCC) is the average squared correlation of a variable on the one set with the canonical variable (CANV) from the other set.

NOTE: ASxSC in the tables that follow are to be read as ASLxSCC.

CANV	ASL 1st.	ASxSC 1st.	ASL 2nd.	ASxSC 2nd.	SCC
1	0.3794	0.0929	0.3488	0.0854	0.2449
2	0.1594	0.0070	0.1883	0.0083	0.0438
3	0.2705	0.0110	0.2292	0.0093	0.0405
4	0.1908	0.0001	0.2337	0.0001	0.0004

APPENDIX B

Form AEH

HOW WE UNDERSTAND INFORMATION AND MAKE DECISIONS

My name is Eric HAMPSON, and I may be reached at 922-7696

I am asking you to take part in a research project which will help us to know more about the way in which people understand written information, and express their own ideas.

If you agree to take part in this project, I shall ask you to:

- (a) Write for about 15 minutes on a topic which you will choose after looking at six illustrations, each of which poses a question.
- (b) Complete a test of mental ability (matching patterns).
- (c) Read silently a mumber of short passages, and check the correct answers to questions on each of the passages.

These three tasks together will take about 60 minutes.

If you prefer to divide these tasks between two sessions, I can arrange for this.

You have the right to withdraw from any task, or from the project as a whole, at any time. If you feel tired or too frustrated to continue with the tasks, or you are not feeling well, you can let me know at once.

Any information which you supply about yourself, and all your answers, are confidential, and will be identified only by a number. This number will be given to you as soon as you feel comfortable about taking part.

I will answer any questions which you may have about the project and, if you wish, I will explain your results.

FORM OF AGREEMENT

I agree to participate as a subject in the research project How We Understand Information and Make Decisions. I understand all the information given to me by the investigator.

Signature . . . . . at Vancouver, B.C.

Date 1988

ACKNOWLEDGMENT

Thank you for agreeing to participate in the research project How We Understand Information and Make Decisions. I have received your Form of Agreement

Signature . . . . . at Vancouver, B.C.

Date 1988

APPENDIX C

Form BEH CONFIDENTIAL

PERSONAL INFORMATION

1. My number is . . . . (Do NOT give your name).

2. I am MALE FEMALE (Circle the term that applies).

3. My age is 20 - 29 . . 30 - 39 . . 40 - 49 . . 50 - 60

4. My father/mother/guardian worked as a
. . . . . .

5. I work as a
. . . . . (Name the work you do)

6. I attended elementary school for . . . . . years

7. I attended secondary school for . . . . . .years

8. I attended other (university, community college, other classes) for . . . . years (Circle the highest one attended).

I understand that if I return a COMPLETED form (PERSONAL INFORMATION) to the examiner, I am agreeing to take part in the project, subject to my having the right to withdraw as stated in Form AEH (HOW WE UNDERSTAND INFORMATION AND MAKE DECISIONS).

APPENDIX D

Form CEH

INSTRUCTIONS FOR OBTAINING A LANGUAGE SAMPLE

1. The examiner makes sure that the subject has a pen or pencil, an eraser, and three sheets of paper (quarto or letter size).

2. The examiner says:

HERE ARE SIX PANELS WHICH ILLUSTRATE SEVERAL ITEMS OF NEWS THAT YOU MAY HAVE DEFINITE OPINIONS ABOUT. CHOOSE THE ONE THAT YOU WOULD LIKE TO DISCUSS IN WRITING.

3. The examiner displays the panels in front of the subject and waits for the subject to choose a topic. In answering any questions from the subject, the examiner should avoid making any remark which could influence the subject's choice of topic.

4. The examiner now says:

I WOULD LIKE YOU TO SPEND ABOUT FIVE MINUTES, JOTTING DOWN A FEW IDEAS; THEN, WHEN YOU ARE READY, TAKE ANOTHER 15 MINUTES TO WRITE AS MUCH AS YOU CAN ABOUT THE TOPIC YOU HAVE CHOSEN. DON'T WORRY IF YOU RUN OUT OF IDEAS. JUST DO YOUR BEST. SPELLING AND PUNCTUATION ARE NOT GOING TO COUNT IN ANY

SCORE; SO DON'T BE CONCERNED IF YOU HAVE PROBLEMS HERE. YOU MAY BEGIN WRITING NOW.

5. Five minutes before the end of the session, the examiner says: YOU HAVE ABOUT FIVE MORE MINUTES IN WHICH TO COMPLETE YOUR WRITING.

6. After collecting the paper from the subject, the examiner says:

THANK YOU FOR HELPING WITH THIS PROJECT. DO YOU HAVE ANY OTHER QUESTIONS?

APPENDIX E

PRINCETON MANUAL GUIDELINES

- Score 1. Response could be generated by single fixed rule; no alternative interpretations are considered; subtle conditional changes would produce no changes in the response. Responses which fit the event into a category (inclusion v exclusion) with a high degree of certainty, which unambiguously reduce conflict and avoid use of gradations (shades of gray and continua) are typically generated by simple structure.
  a. Viewing conflict, uncertainty or ambiguity as unpleasant or as a flaw or weakness in people or functioning.
  b. Seeking fast and unambiguous closure or resolution, and reacting in such a way as to engage internally consistent processes which reduce incongruity or dissonance.
  c. Offering a specific guide or rule for reducing conflict.
  d. Implying that an absolute solution can be found.
  e. Stating that effects are compartmentalized, are all one way or all another way.
  f. Presenting only one side of a problem; ignoring differences and similarities with other views.

- Score 2. When response signifies a qualification of an absolute rule but is not clearly identified as an alternative interpretation.
- Score 3. Clear representation of availability of alternative rule structures for perceiving the event. the response must indicate the simultaneous generation of alternate and different perceptions of the same information. It also includes a conditional rule for specifying when each interpretation is used.
  a. Listing similarities and differences between views, without considering relationships.
  b. Specifications of at least two different interpretations of the event in the stem [or stimulus].
  c. Presence of "either-or" type responses expressing a possible conditional rule about two ways of categorizing.
  d. Probability statements about the occurrence of different views of outcomes.
  e. Reaction against absolutism in general (implying more than one view is not necessarily being "anti" particular view which could indicate a low level fixed rule structure).
  f. The avoidance of dependency on external imposition, i.e., clearly implying availability of alternatives.

- Score 4. When confident that the response implies alternate interpretations and also implies that both can interact, but the interaction is expressed as qualification rather than the emergence of comparison rules.
- Score 5. Response must give evidence not only of alternative interpretations but of the use of comparison rules for considering the *joint* as opposed to the conditional outcome of these different perceptions. At this level differences can be held in focus simultaneously and viewed as having interactive effects . . . expresses the joint operation directly and the other processes must be inferred.
  a. The integration of two conflicting or different interpretations so as to preserve and not "ward off" the conflict.
  b. The generation of various meanings of alternate perceptions, e.g., various meanings of the perception of conflicting views about a person.
  c. Evidence that the completion implies the ability to take another person's intentions (or perceptions) into account and to relate different perceptions of different people.
  d. Implication that one's behaviour is affected by the way another behaves as in a give-and-take strategy

game.

e. A view of social relationships anchored in mutual responsibility (as opposed to fixed beliefs or rules) in which each person can "place himself in the other person's shoes" (relate alternate schema).

f. The consideration of alternate reasons for similarities and differences.

- Score 6. Indications that the simultaneous operation of alternatives and some evidence of the consideration of functional relations between them.
- Score 7. Not only states or implies that alternative perceptions occurred and were simultaneously held in focus and compared but also indicates that the outcomes of various comparisons can be considered in producing causal statements about the functional relations between "ways of viewing the world." . . .

a. Conflicting alternatives which were viewed as leading to new organizations and information.

b. The utilization of alternatives through exploratory action in order to obtain new information.

c. Generation of functional relations between alternatives.

d. Consideration of relationships among similarities and differences between the sides of a problem or question and the development of relationships

between alternate reasons as to why these differences and similarities exist.

e. The production of more "connectedness" between alternatives by theorizing as to why these reasons exist.

APPENDIX F

COPIES OF THE COLLAGES (*INFORMATION*)

The following three pages illustrate the collages which were used as the stimuli for the language samples. These language samples were assessed for both syntactic skill (*Syntactic Performance*) and maturity of judgment in discussing one or other of the topics displayed (*Information*).

SPECIAL ACKNOWLEDGMENT

The author wishes to thank the Publishers and Editors of *TIME The Weekly Newsmagazine* and of *CHATELAINE*, who gave permission for the use of a cover and several illustrations in the panels contained in the pages which follow. Their help was essential to the preparation of this dissertation.

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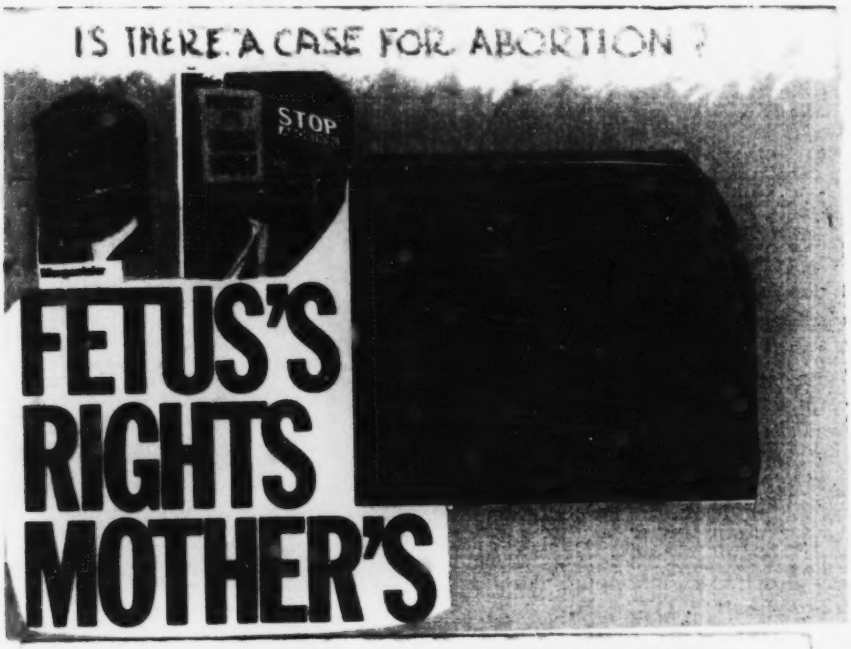

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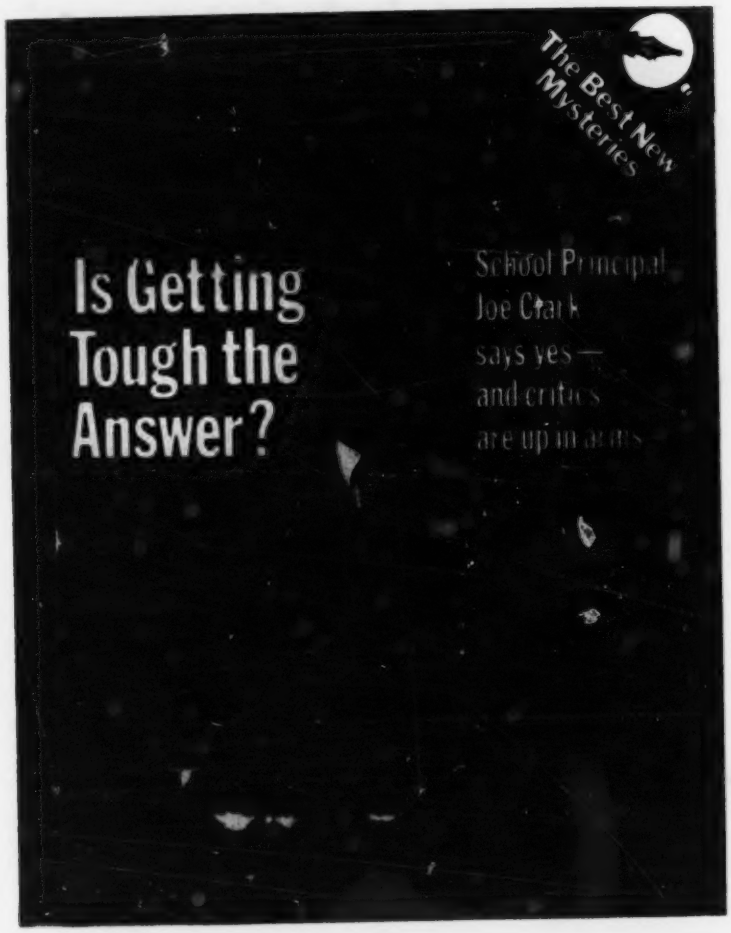

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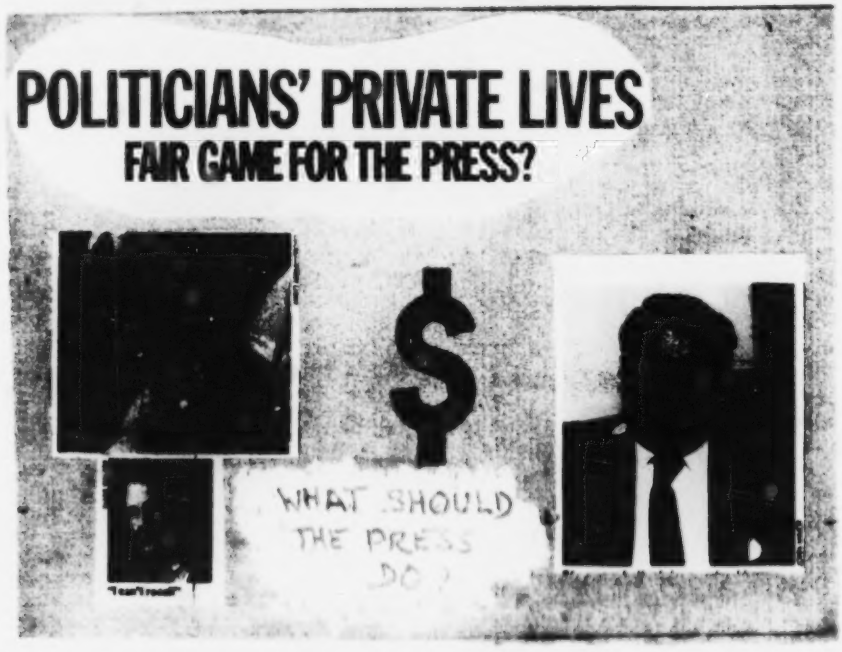

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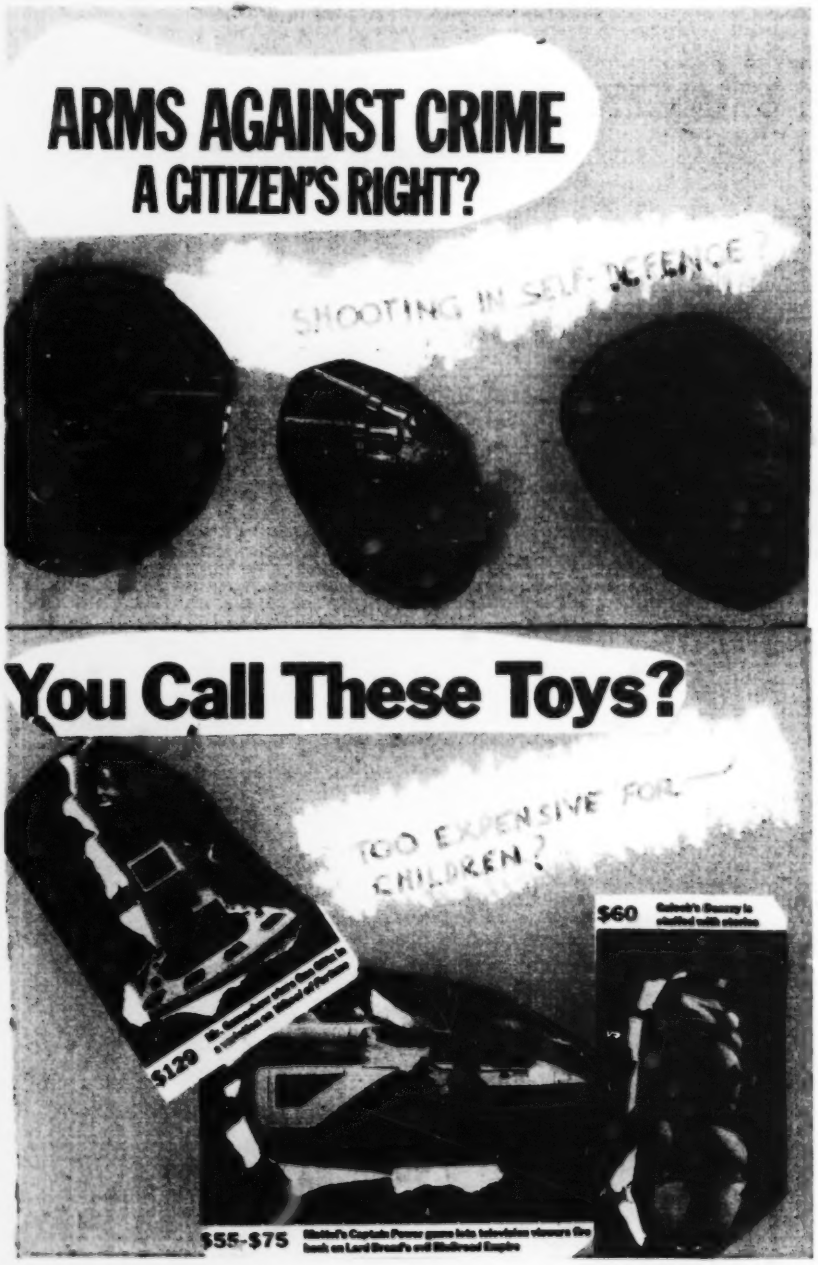

APPENDIX G

Davis reading Test: Substraction Table

No. Incorrect	Deduct
0-2	0
3-6	1
7-10	2
11-14	3
15-18	4
19-22	5
23-26	6
27-30	7
31-34	8
35-38	9
39-42	10

APPENDIX H

Examples of a Language Sample

I'm not sure if tough is the right word, but yes, I do believe there should be stronger laws within the school curriculum. I come from the era of the strap we all survived it, but halfway through school the strap was barred. I remember how slowly each student changed, and the main joke among us was "Well what are they going to do? send me to the corner make me pick up garbage, no big deal.

As I reached my high school days, I found a lot of the students to be mouthy, disruptive and downright rude to the teacher. this made it tough for those wanted to teach and those who wanted to learn. It was getting so out of hand that we as students put out a petition to bring the strap back into the schools. I remember a high percentage of the kids signed. Our principal was surprised but nothing was ever done.

This is almost a prime example of when parents were told not to strap your kids, allow them to express themselves and now I see kids with no respect and bad mouths who wont be told what to do.

These kids are the same kids that are entering into our schools and then into society as productive persons. Yet how can she/he be told what to do if they couldn't be told at home or school.

Yes, I believe they should get tougher but not to overdo it: these kids are our future and their kids and so on.

If you look at past history when laws and rules began to slacken so did the respect of the people.

Think about it.

This subject was awarded the following scores for the language sample (*Syntactic Performance* and *Information*) and in the two standardized tests (*Comprehension: Davis Reading Test* and *Mental Ability: Test of Non-verbal Intelligence*). All scores have been converted to T-scores (Mean = 50; Standard Deviation = 10) for easy comparison:

Syntactic Performance = 67

Comprehension = 16

Mental Ability = 36

Information = 64 (Score 5.0 on Schedule)

The scores for the individual elements of *Syntactic Performance* converted to T-scores :

Score for Verbs = 82

Variety of Clauses = 62

Elaboration of the Subject and Predicate = 49.8